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Takai et al.

(10) **Patent No.: US 9,095,475 B2**
(45) **Date of Patent: Aug. 4, 2015**

(54) **APPARATUS AND METHOD FOR MANUFACTURING A TAMPON**

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(73) Assignee: **UNICHARM CORPORATION**, Ehime (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 945 days.

(21) Appl. No.: **13/056,384**

(22) PCT Filed: **Jul. 17, 2009**

(86) PCT No.: **PCT/JP2009/062938**

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(2), (4) Date: **Apr. 14, 2011**

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PCT Pub. Date: **Feb. 4, 2010**

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(30) **Foreign Application Priority Data**

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Aug. 29, 2008 (JP) 2008-222213
Sep. 29, 2008 (JP) 2008-251447

(51) **Int. Cl.**
A61F 13/20 (2006.01)

(52) **U.S. Cl.**
CPC ***A61F 13/2085*** (2013.01)

(58) **Field of Classification Search**
CPC A61F 13/2085
USPC 29/771, 783, 791; 28/118, 119; 604/385.1, 385.17–385.18, 904; 264/320; 425/392, 393
See application file for complete search history.

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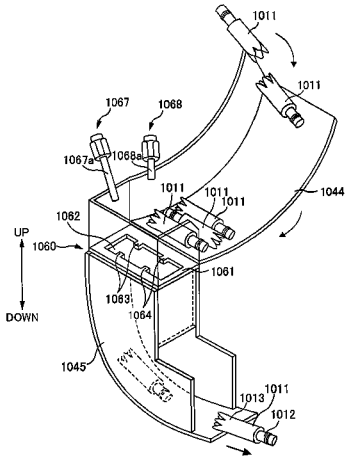
Primary Examiner — David Bryant
Assistant Examiner — Steven A Maynard
(74) *Attorney, Agent, or Firm* — Lowe Hauptman & Ham, LLP

(57) **ABSTRACT**

An apparatus for manufacturing a tampon which includes an absorbent body, an accommodating member and a pushing member, includes: an orienting mechanism; a first inserting mechanism that inserts the pushing member into the accommodating member; and a second inserting mechanism that inserts the absorbent body into the accommodating member in which the pushing member is inserted. The orienting mechanism has an opening through which the accommodating member is inputted; a pair of first protruded parts; and a pair of second protruded parts located on other-end side in the longitudinal direction of the opening and protruding inwardly in an opposing manner into the opening, a gap between the pair of first protruded parts, and a gap between the pair of second protruded parts being greater than the external diameter of the minor diameter part and smaller than the external diameter of the major diameter part.

6 Claims, 38 Drawing Sheets



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Extended European Search Report issued Apr. 11, 2013 corresponds to EP Patent application No. 09802848.3.
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Office Action as mailed on Mar. 5, 2013 in corresponding Japanese Patent Application No. 2008-251447.
Office Action as mailed on Mar. 5, 2013 in corresponding Japanese Patent Application No. 2008-198349.
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Notification of the Second Office Action in corresponding Chinese Application No. 201310142053.2 dated Nov. 25, 2014.

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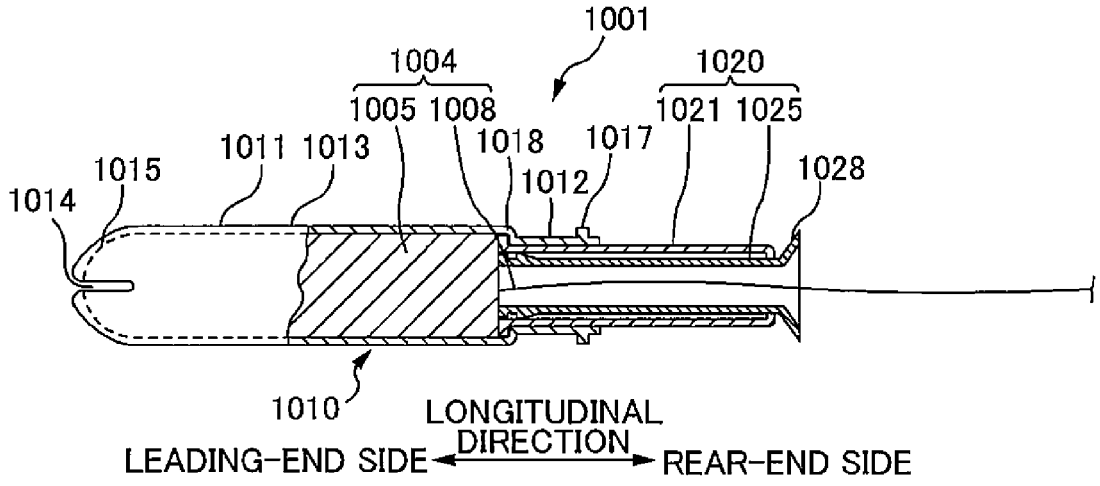
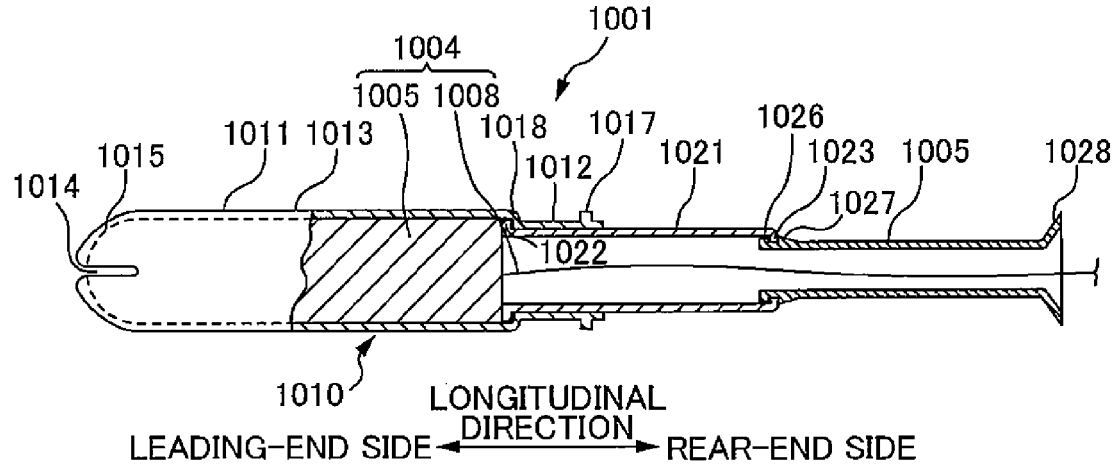

1001
1004
1020
1005 1008
1021 1025
1011 1013
1018
1017
1015
1012
1028
1014
1010
LONGITUDINAL DIRECTION
LEADING-END SIDE
REAR-END SIDE

FIG. 1A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1005 1008
1011 1013
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1021
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1014
1027
1022
1010
LONGITUDINAL DIRECTION
LEADING-END SIDE
REAR-END SIDE

FIG. 1B

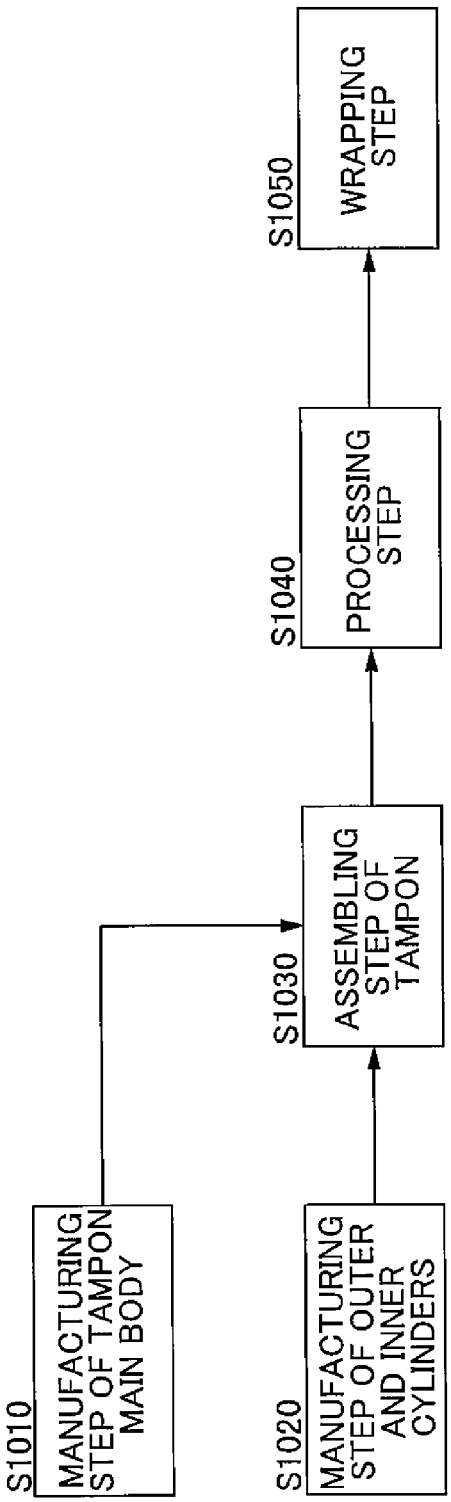

S1010
MANUFACTURING STEP OF TAMPON MAIN BODY
S1020
MANUFACTURING STEP OF OUTER AND INNER CYLINDERS
S1030
ASSEMBLING STEP OF TAMPON
S1040
PROCESSING STEP
S1050
WRAPPING STEP

FIG. 2A

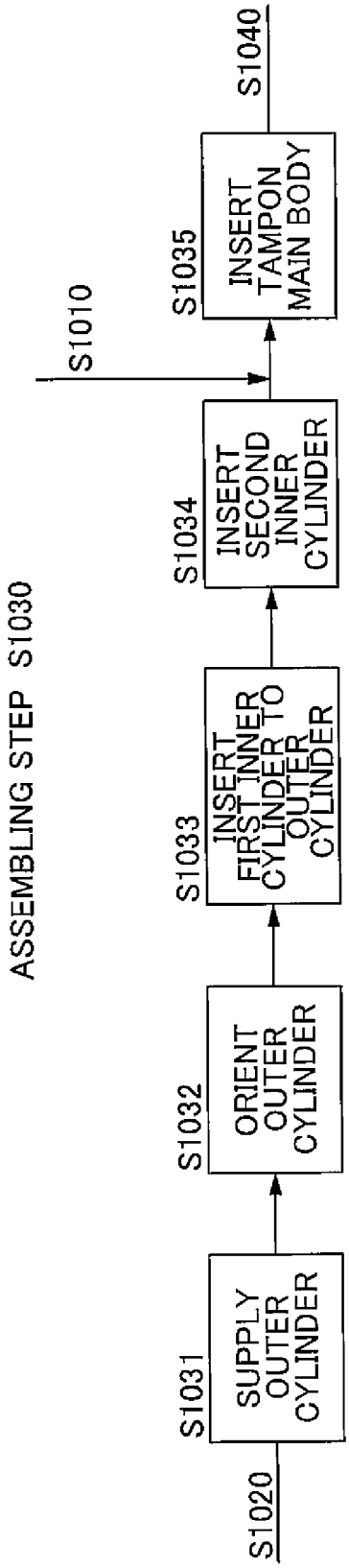

ASSEMBLING STEP S1030
S1020
S1031
SUPPLY OUTER CYLINDER
S1032
ORIENT OUTER CYLINDER
S1033
INSERT FIRST INNER CYLINDER TO OUTER CYLINDER
S1034
INSERT SECOND INNER CYLINDER
S1010
S1035
INSERT TAMPON MAIN BODY
S1040

FIG. 2B

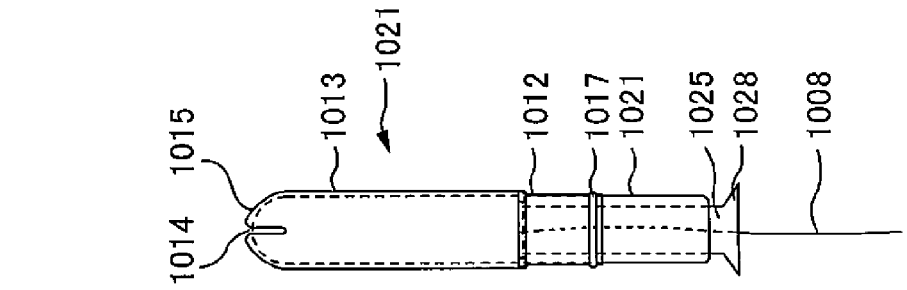


FIG. 3D

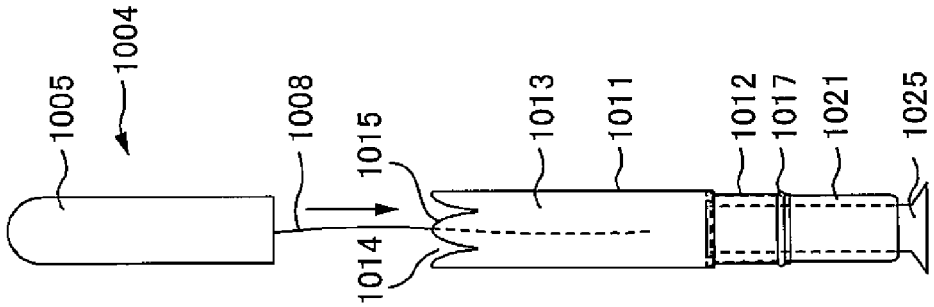


FIG. 3C

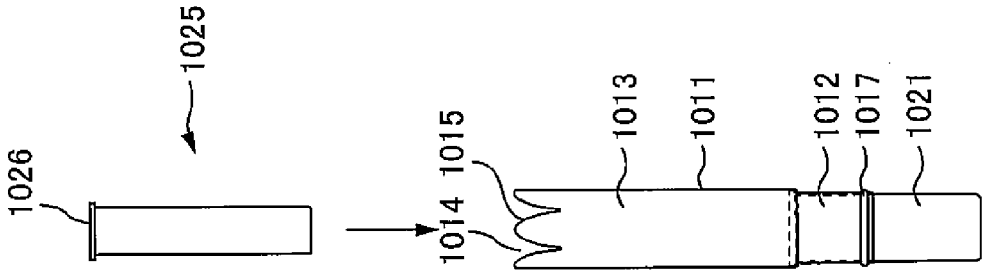


FIG. 3B

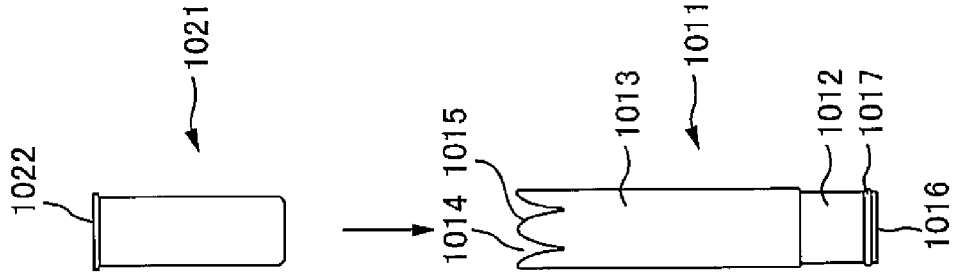
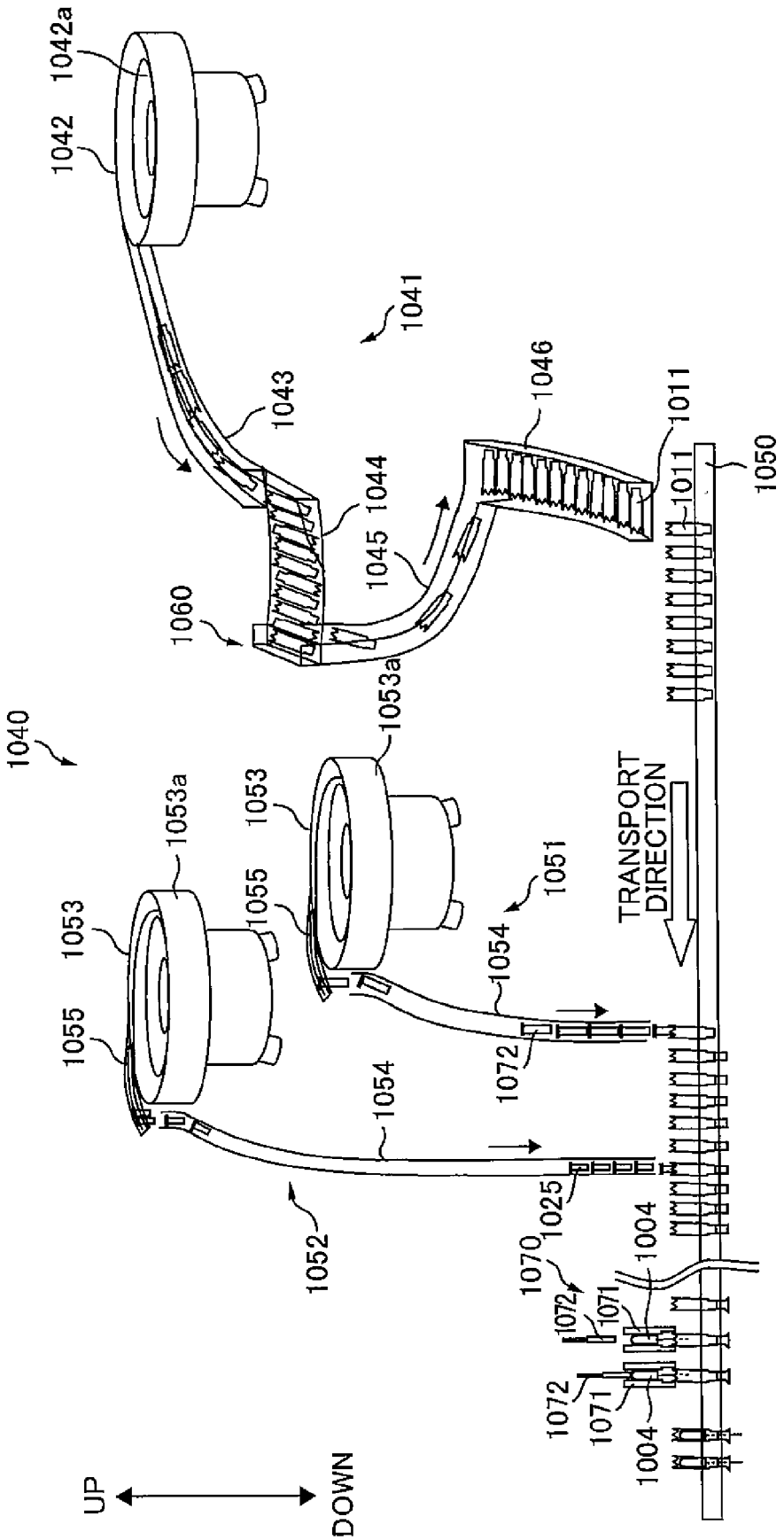


FIG. 3A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1042
1041
1043
1046
1011
1050
1044
1045
1060
1053a
1040
1053
1055
1051
TRANSPORT DIRECTION
1054
1072
1052
1025
1070
1004
1071
UP
DOWN

FIG. 4

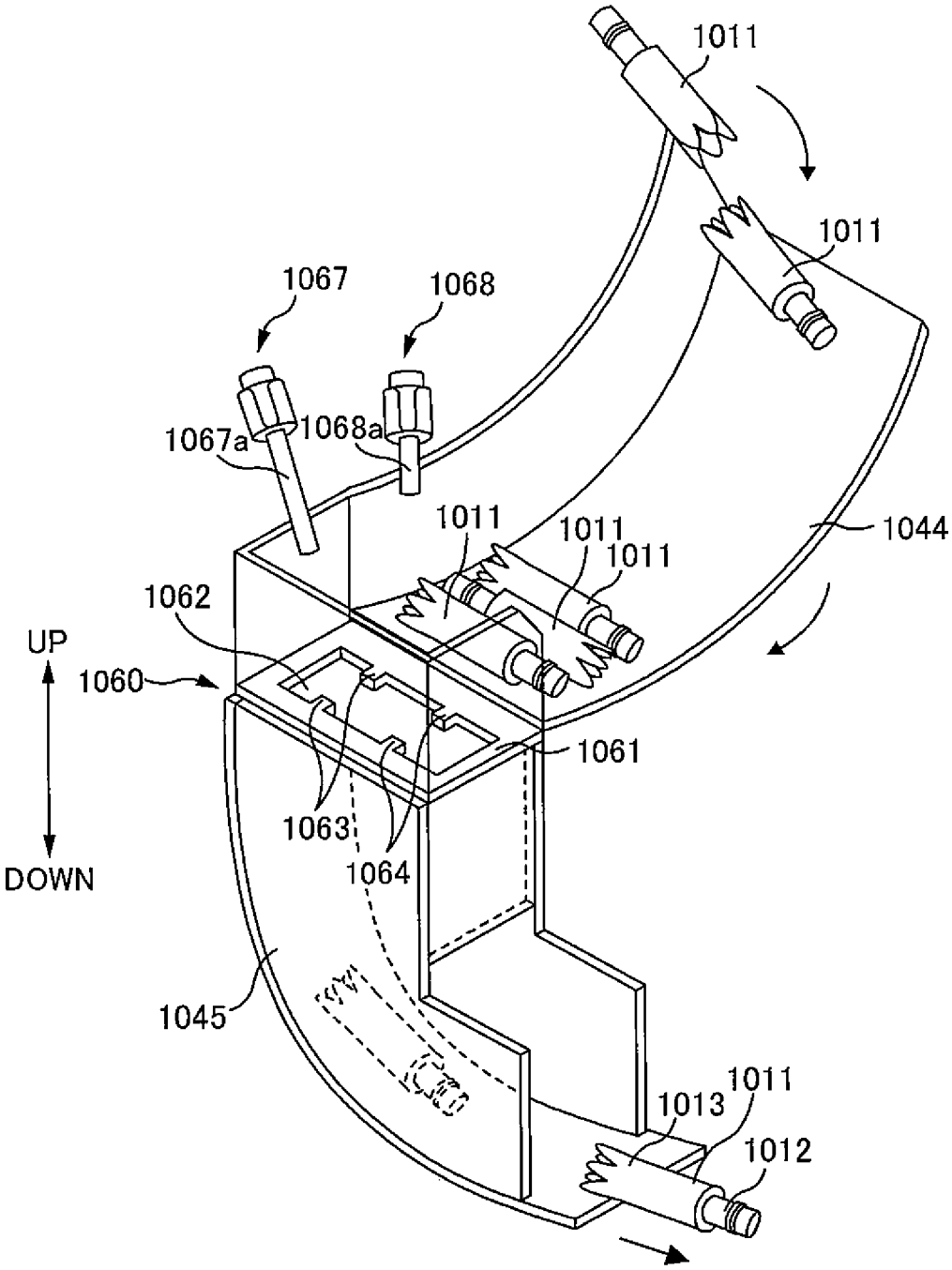

1011
1011
1067
1068
1067a
1068a
1011
1011
1011
1044
1062
UP
1060
1061
1063
1064
DOWN
1045
1011
1013
1012

FIG. 5

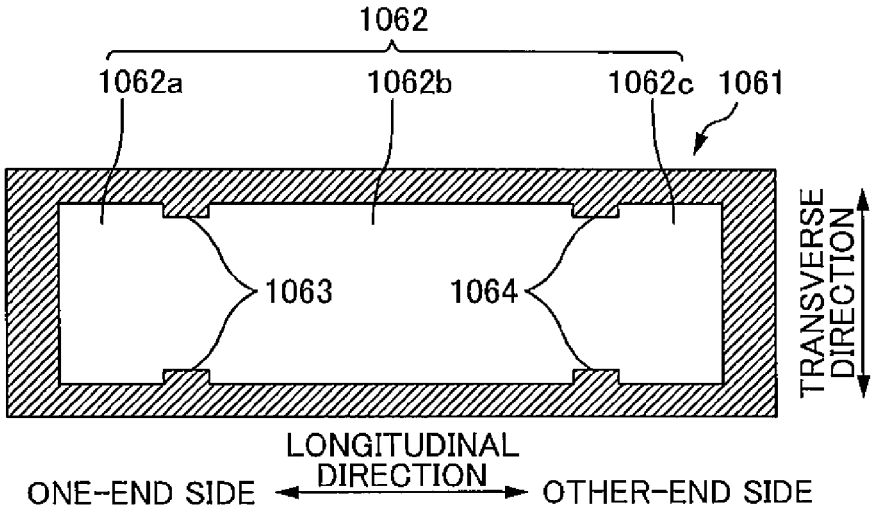


FIG. 6

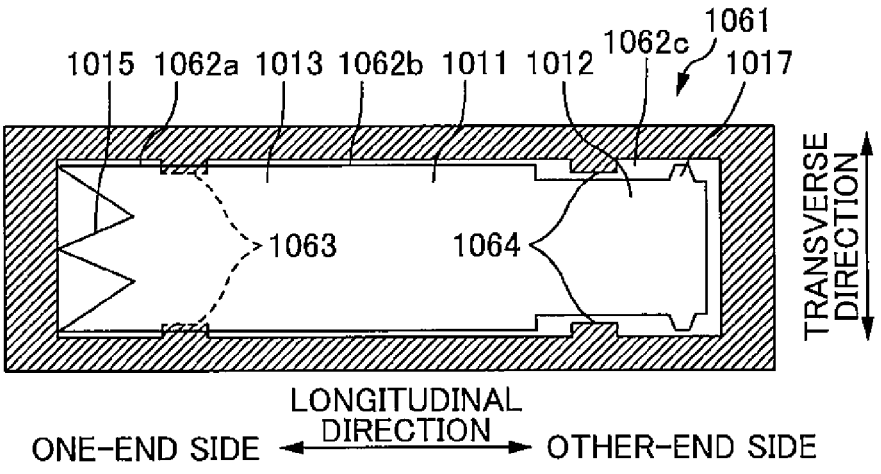


FIG. 7A

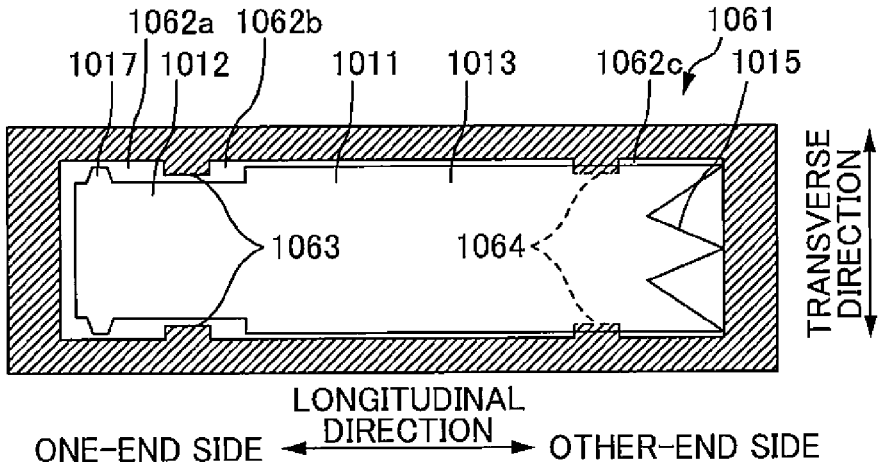


FIG. 7B

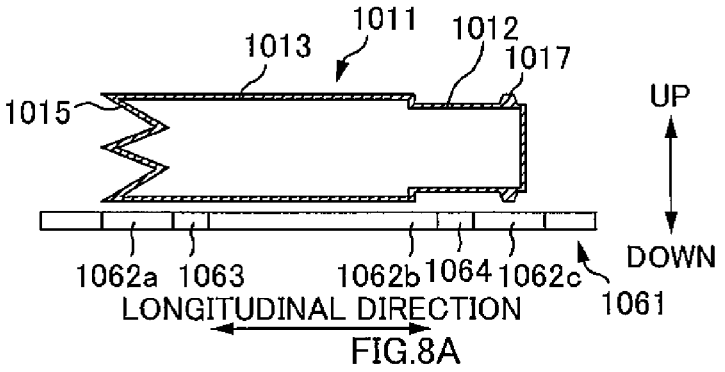


FIG.8A

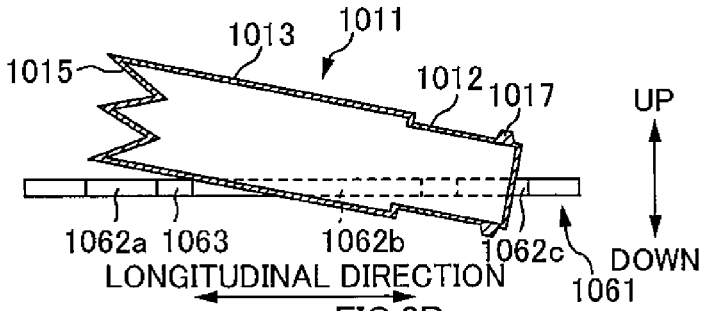


FIG.8B

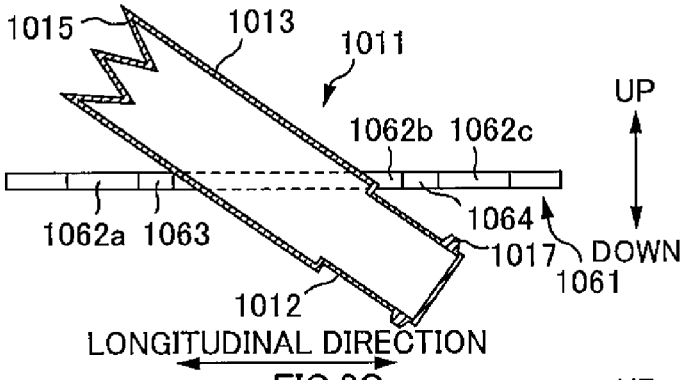


FIG.8C

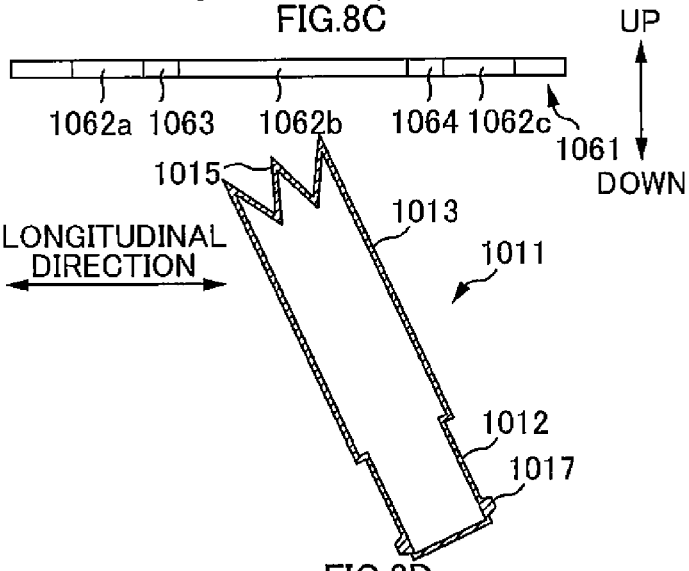
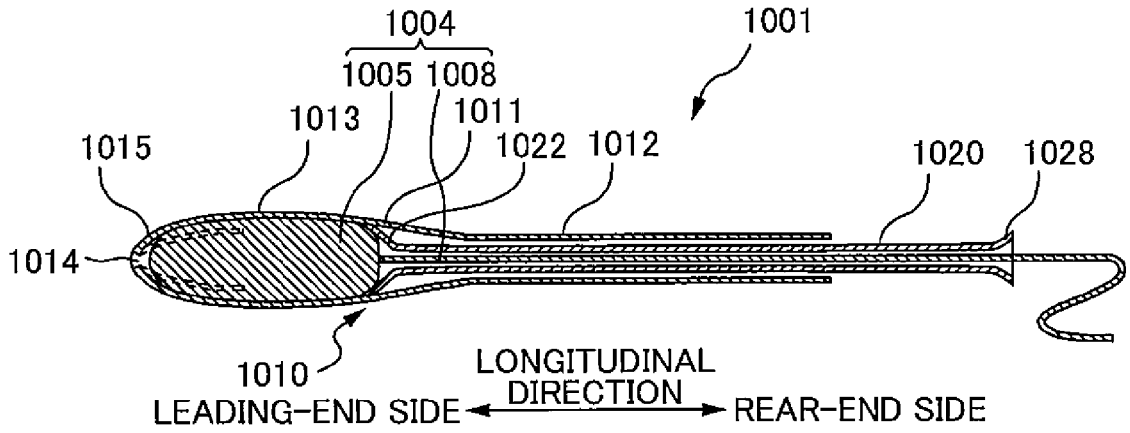


FIG.8D


1004
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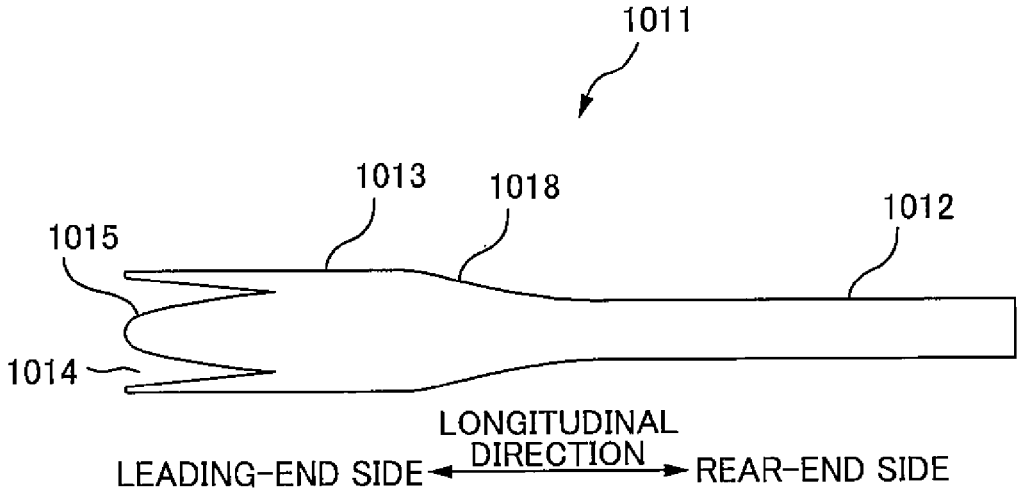
1001
1013
1011
1015
1022 1012
1020 1028
1014
1010
LONGITUDINAL DIRECTION
LEADING-END SIDE
REAR-END SIDE

FIG. 9A


1011
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1012
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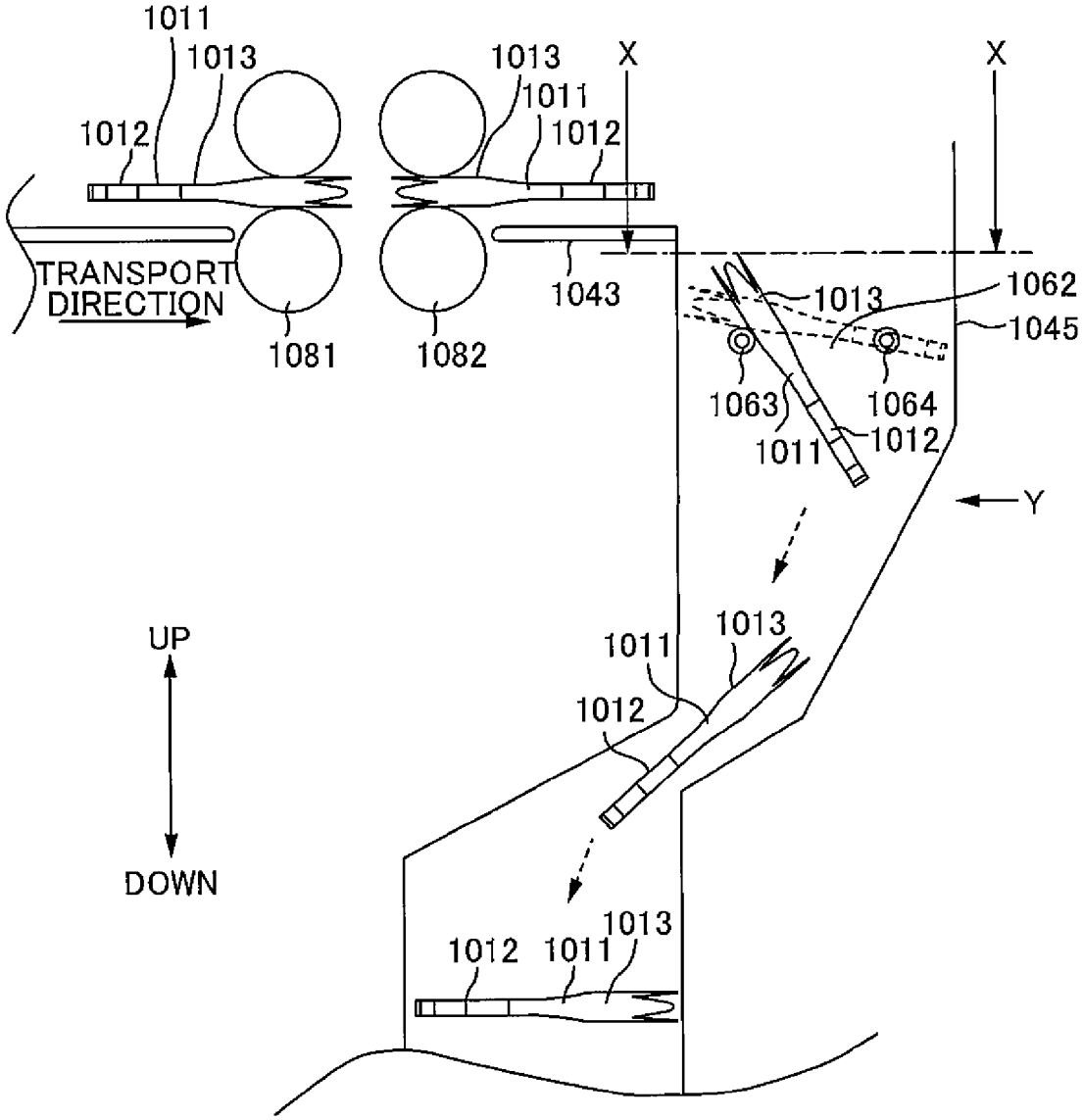
1014
LONGITUDINAL DIRECTION
LEADING-END SIDE
REAR-END SIDE

FIG. 9B


1011
1013
1012
TRANSPORT DIRECTION
1081
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1011
1012
X
1043
X
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1011
1012
Y
UP
DOWN
1011
1013
1012
1012
1011
1013

FIG. 10

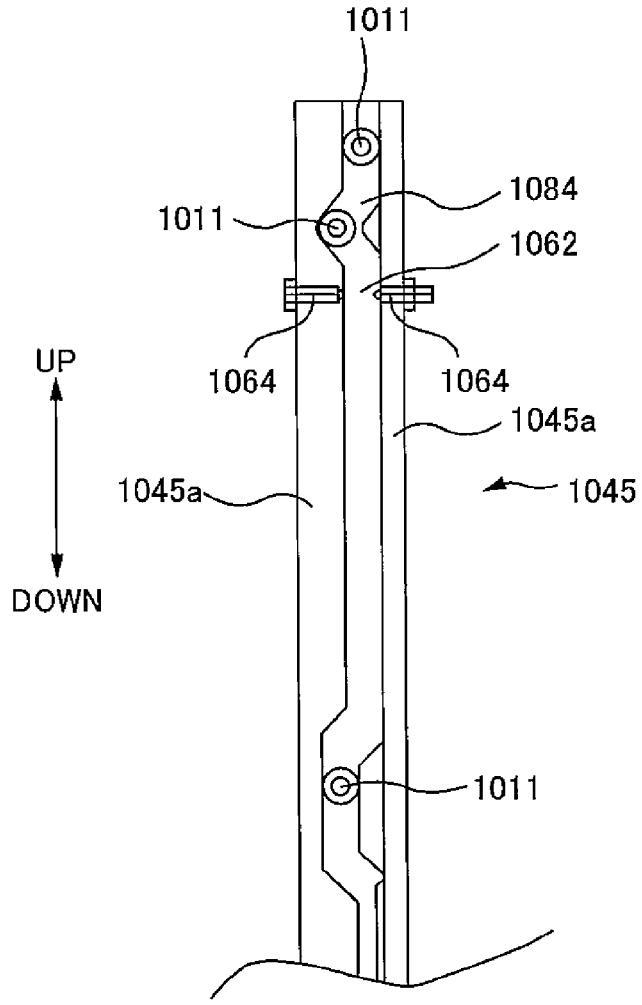


FIG. 11A

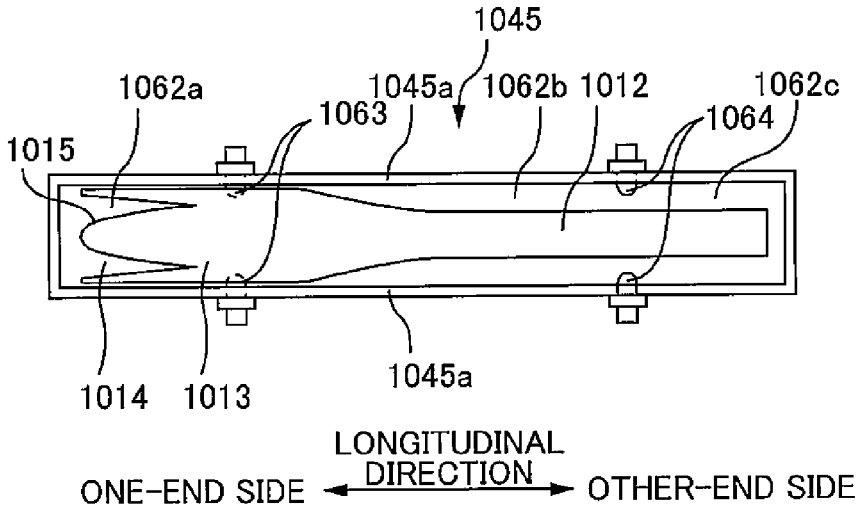


FIG. 11B

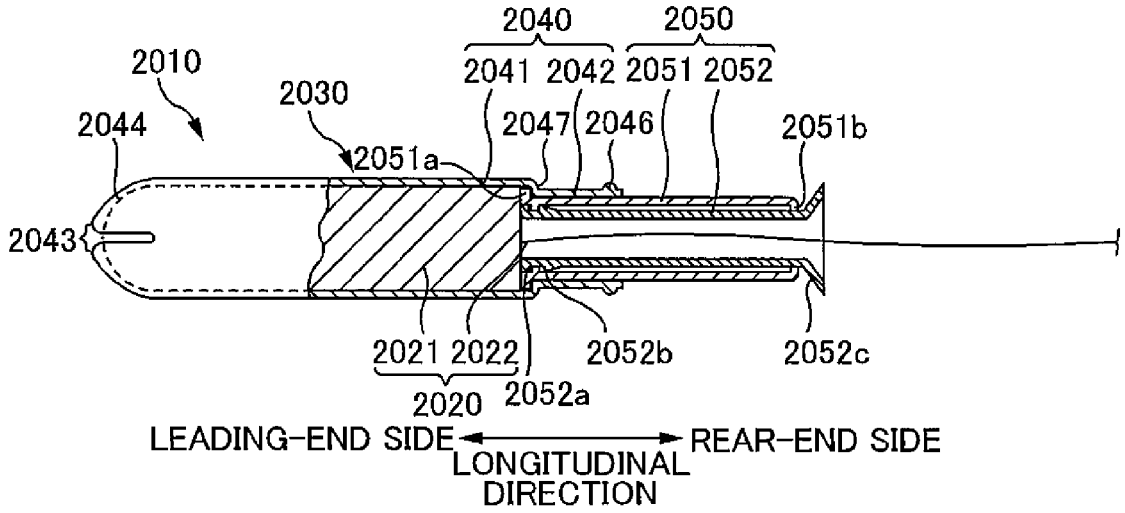


FIG. 12

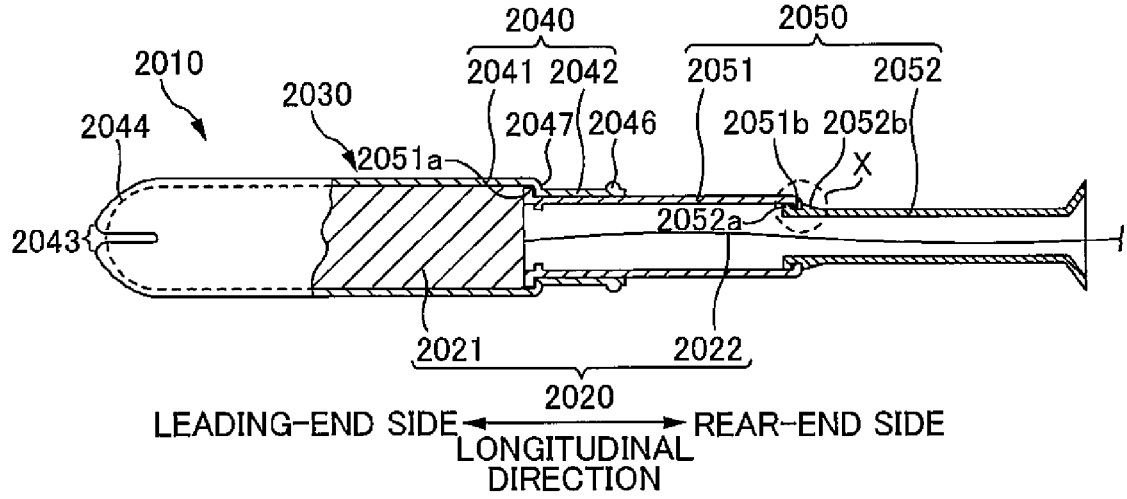


FIG. 13

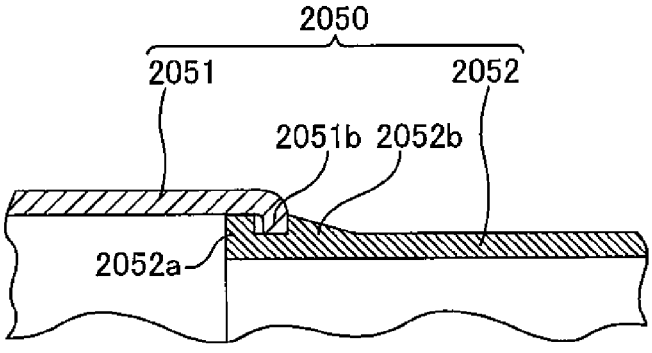


FIG. 14

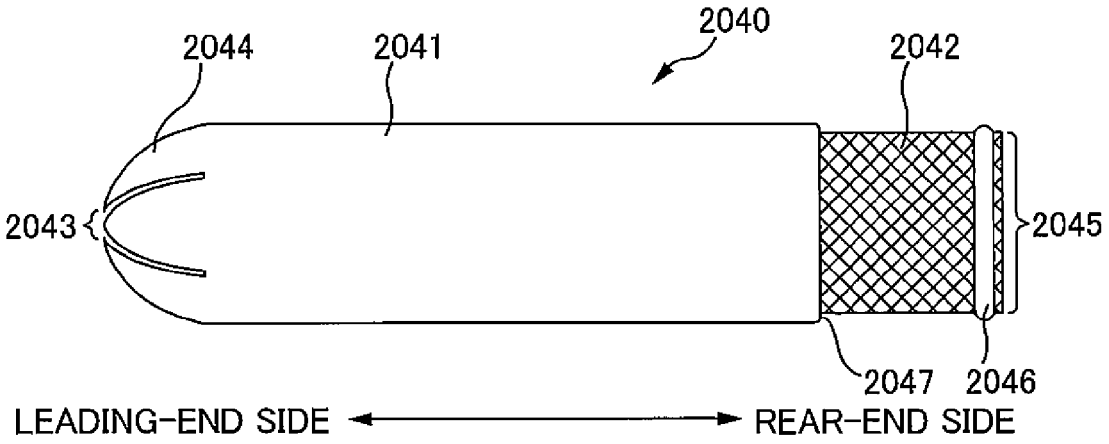


FIG. 15A

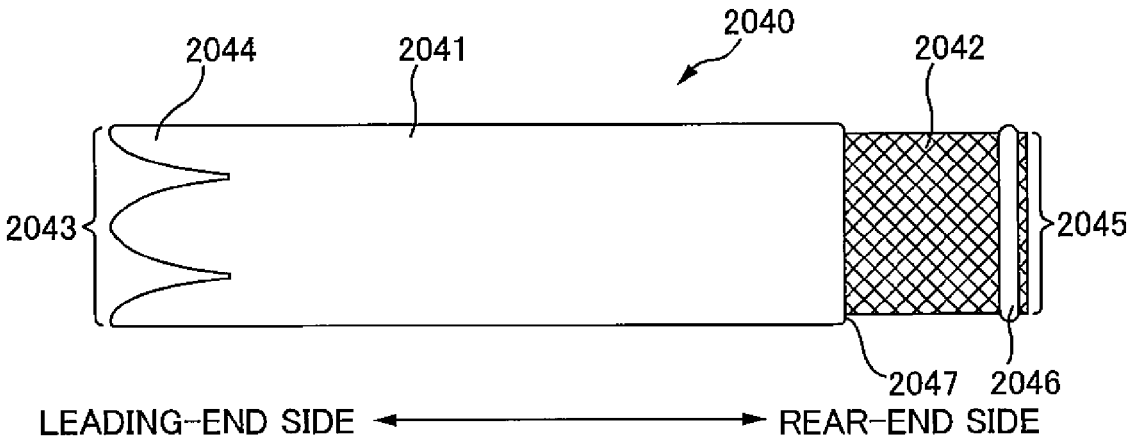


FIG. 15B

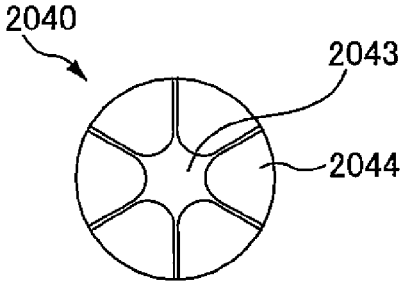


FIG. 15C

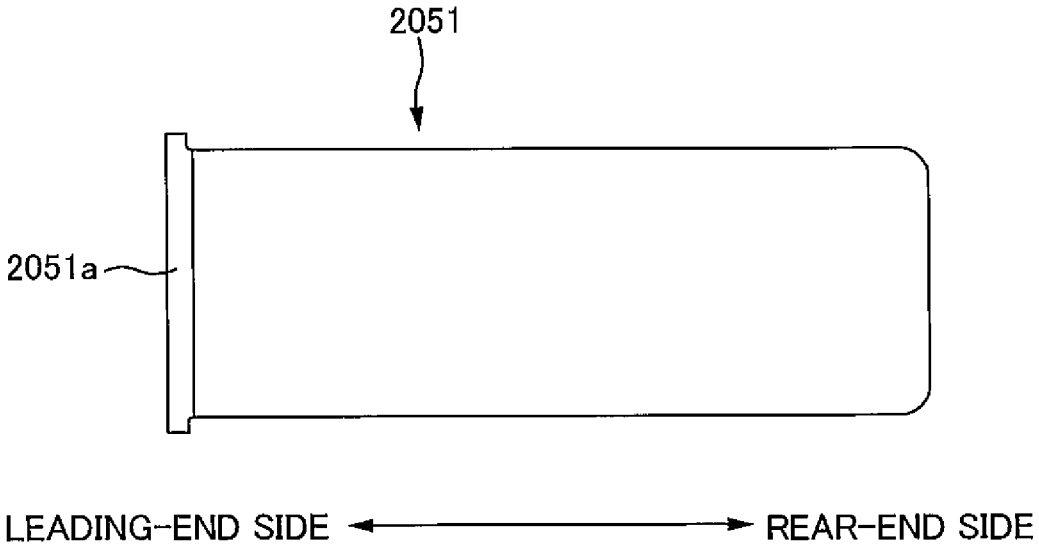

2051
2051a
LEADING-END SIDE
REAR-END SIDE

FIG. 16

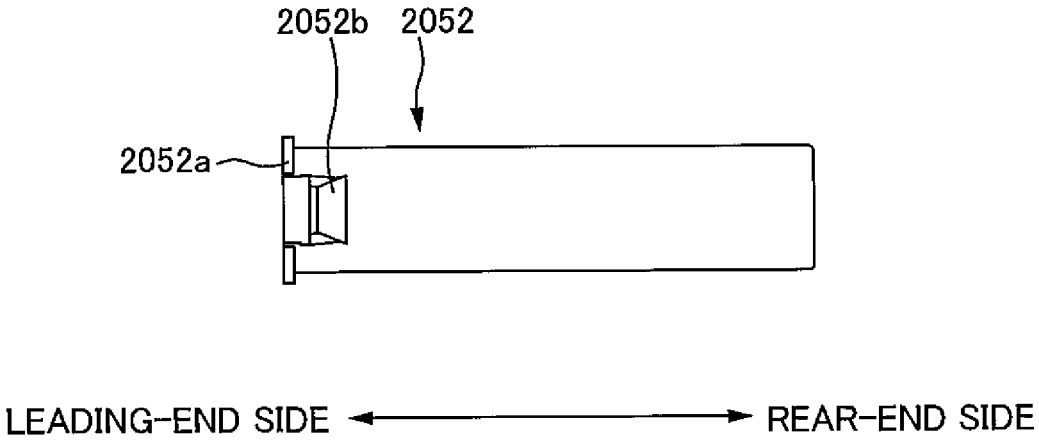

2052b
2052
2052a
LEADING-END SIDE
REAR-END SIDE

FIG. 17

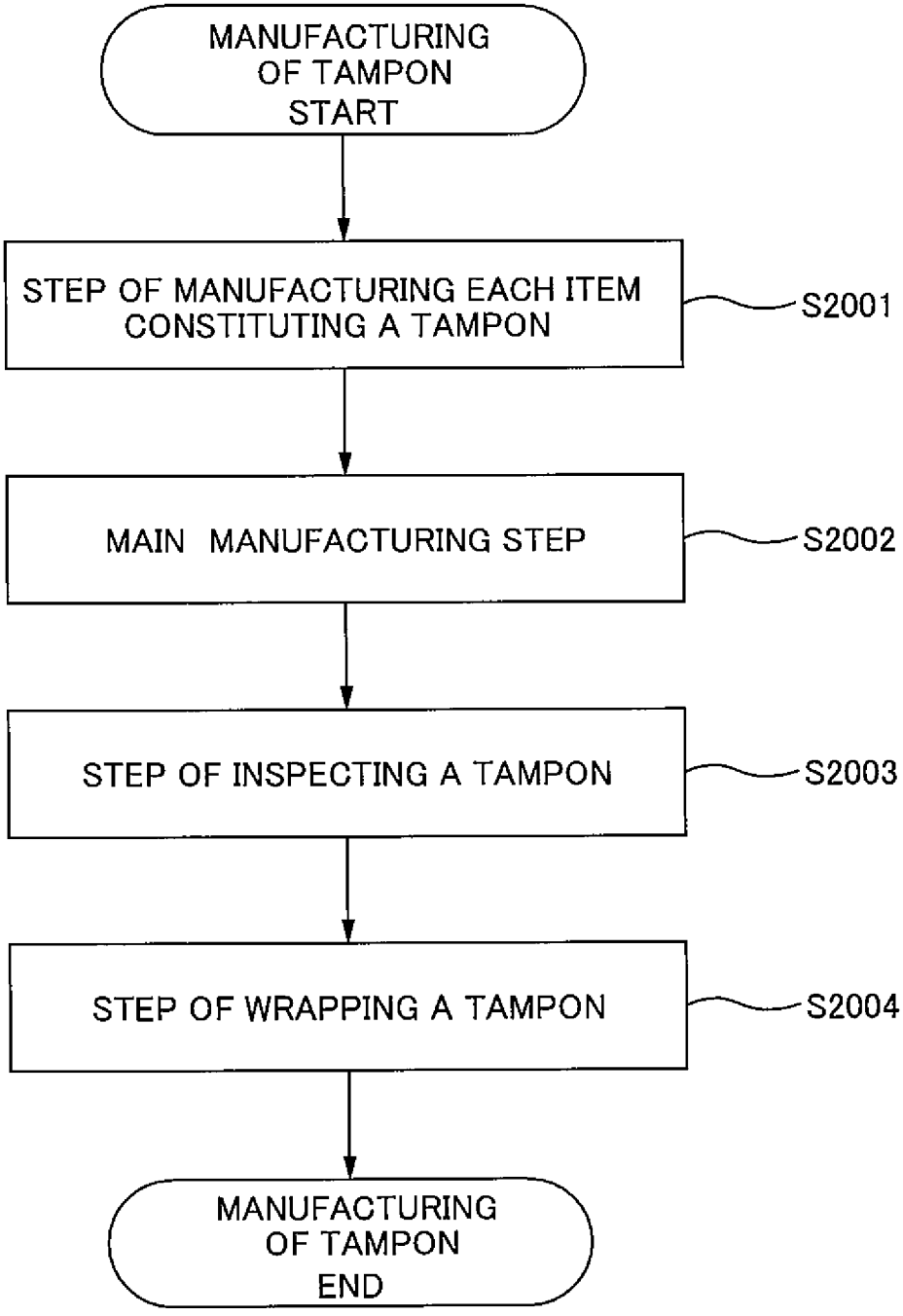

MANUFACTURING OF TAMPON START
STEP OF MANUFACTURING EACH ITEM CONSTITUTING A TAMPON
S2001
MAIN MANUFACTURING STEP
S2002
STEP OF INSPECTING A TAMPON
S2003
STEP OF WRAPPING A TAMPON
S2004
MANUFACTURING OF TAMPON END

FIG. 18

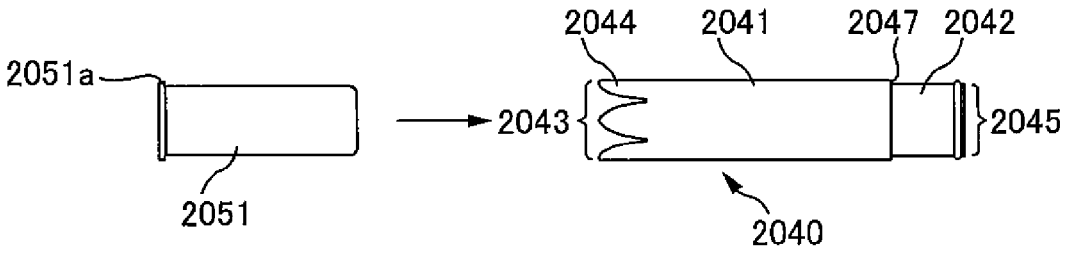


FIG. 19A

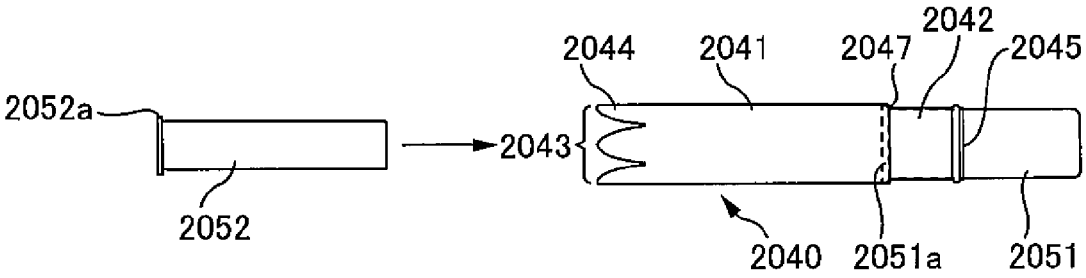


FIG. 19B

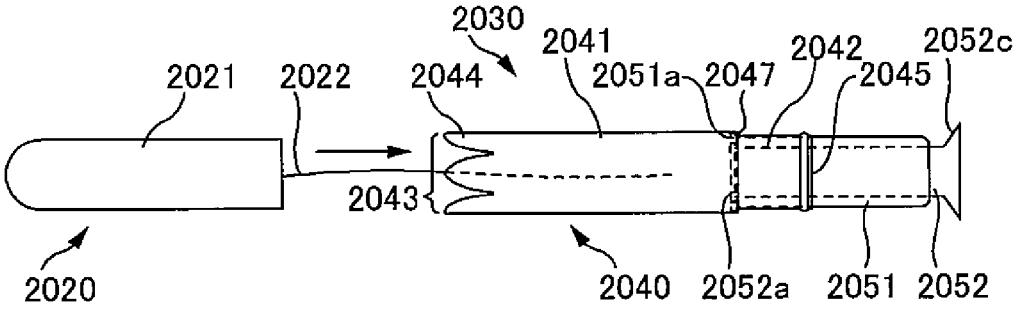


FIG. 19C

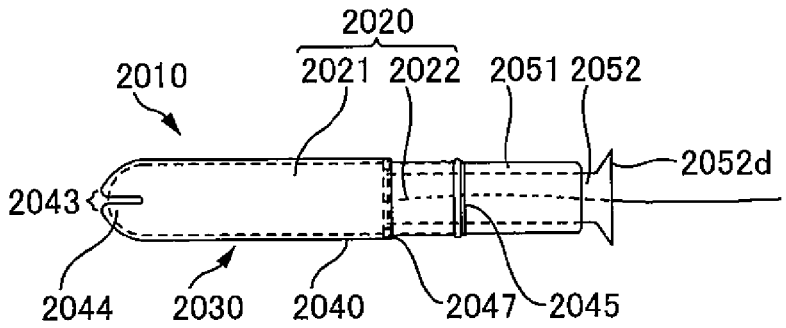
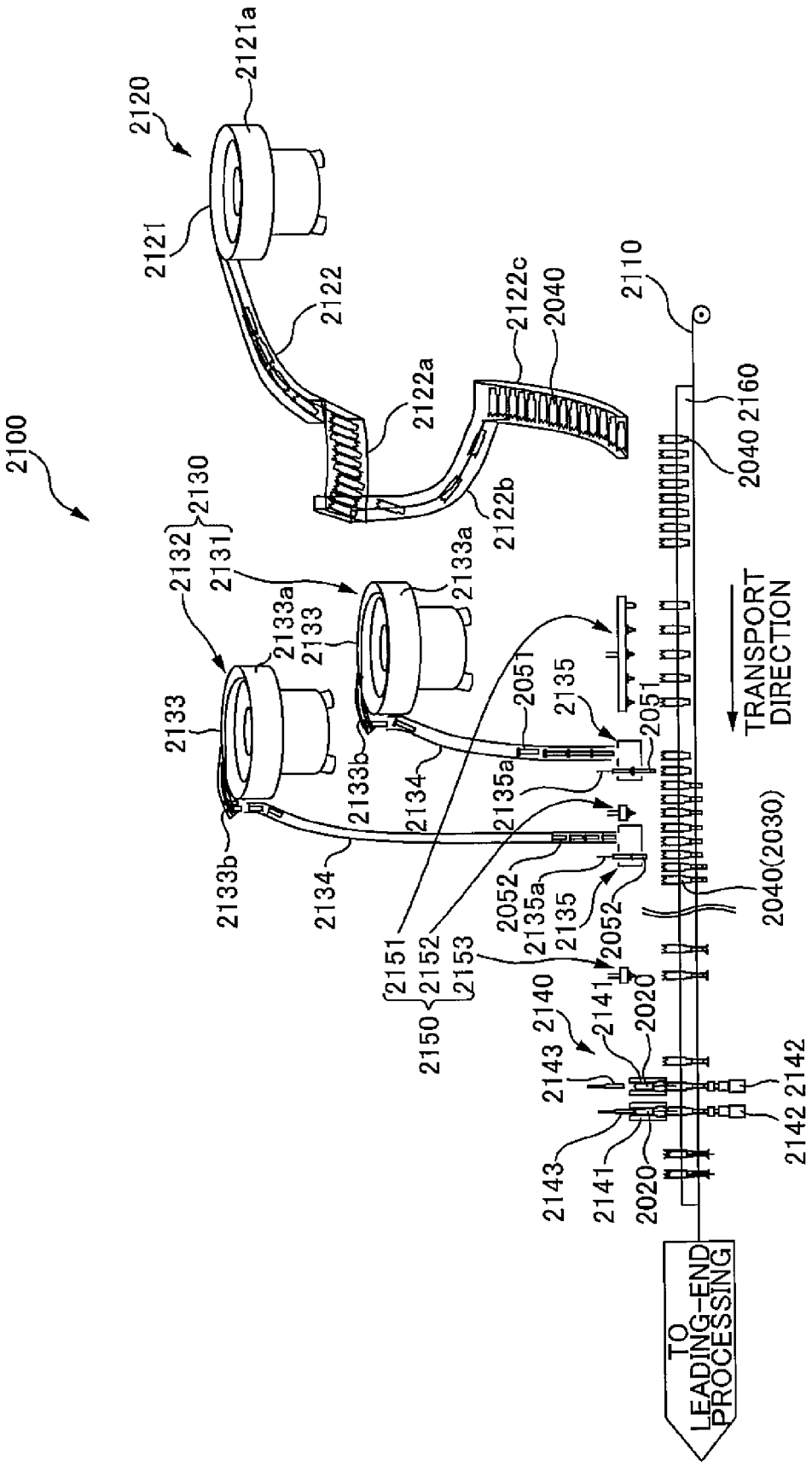


FIG. 19D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2120
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2122a
2122b
2122c
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2110
2040 2160
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2133b
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2135a
2051
2052
2151
2152
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2141
2143
2020
2142
2040(2030)
TRANSPORT DIRECTION
TO LEADING-END PROCESSING

FIG. 20

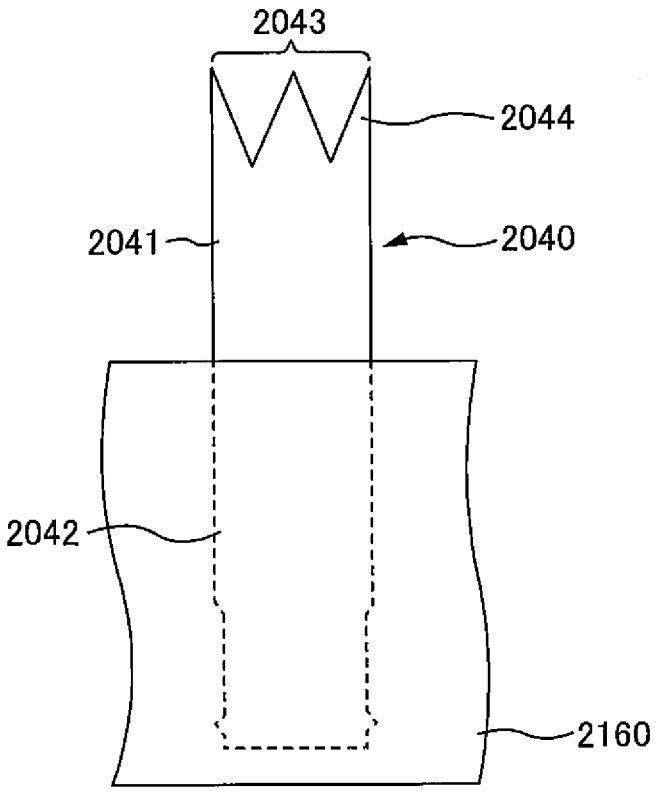

FIG. 21

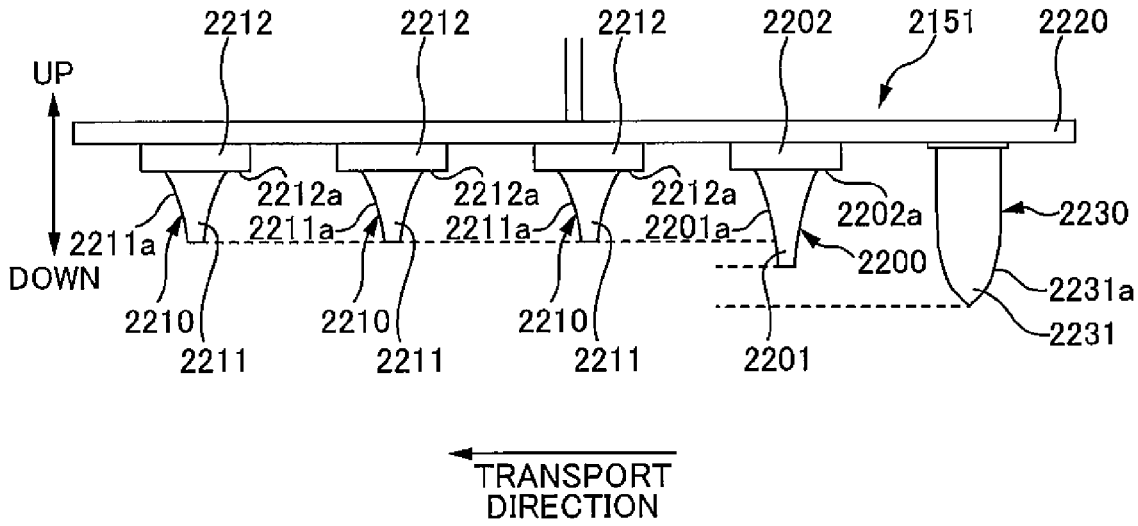

FIG. 22A

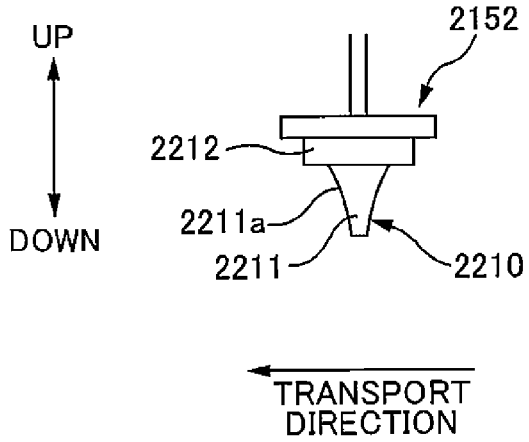

FIG. 22B

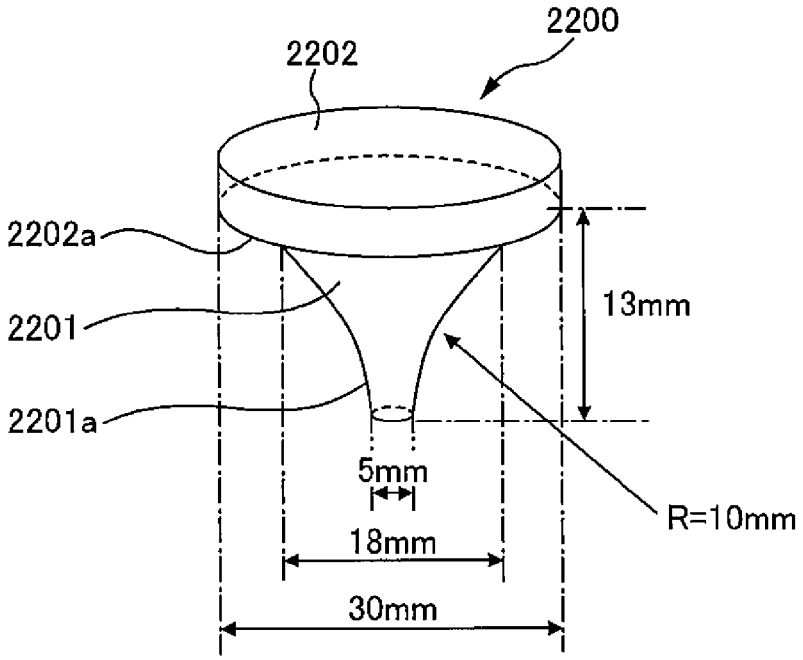
2200
2202
2202a
2201
2201a
13mm
5mm
R=10mm
18mm
30mm

FIG. 23

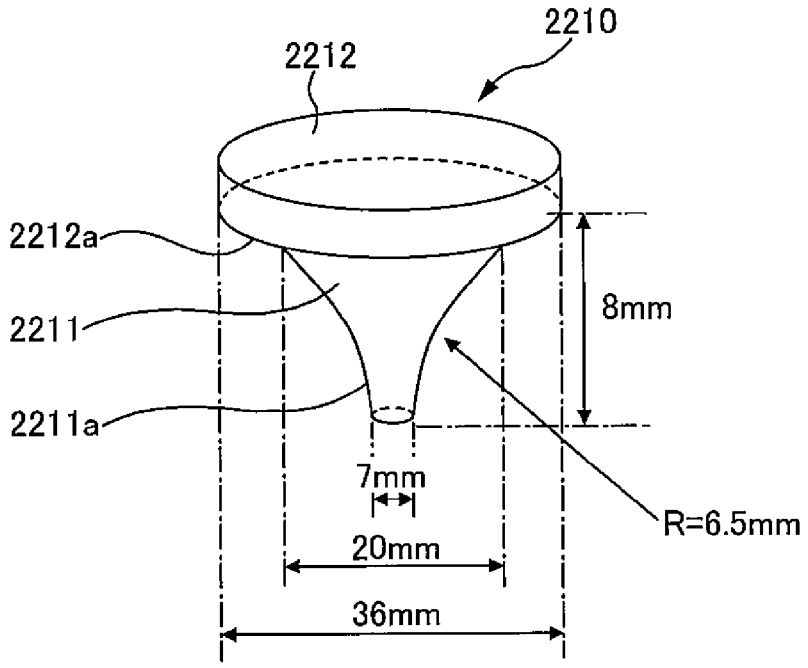
2210
2212
2212a
2211
2211a
8mm
7mm
R=6.5mm
20mm
36mm

FIG. 24

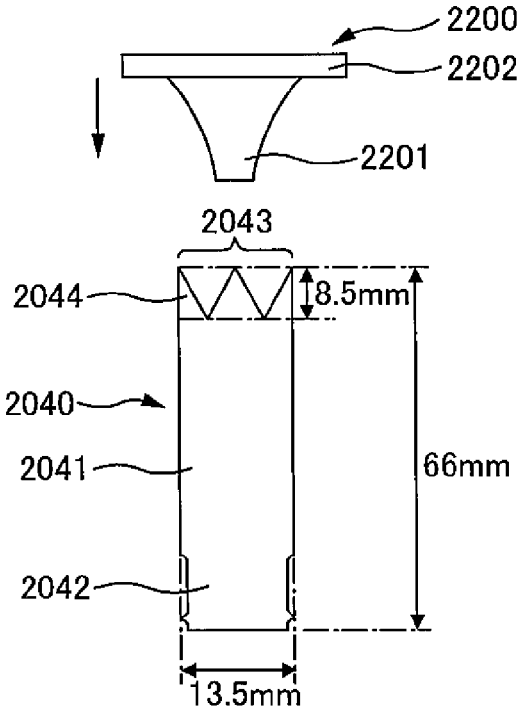

FIG. 25A

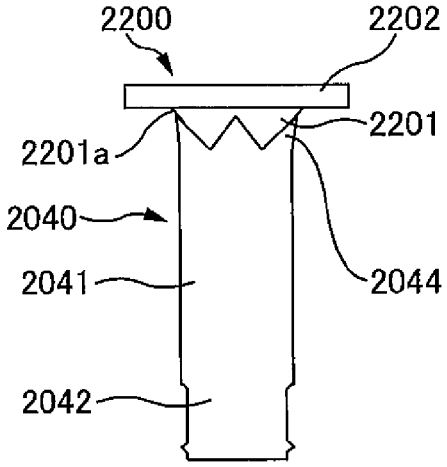

FIG. 25B

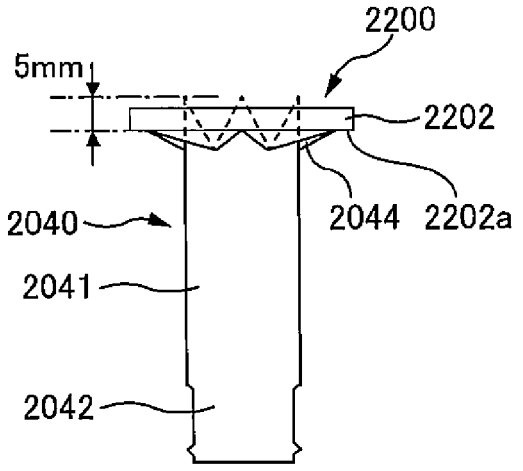

FIG. 25C

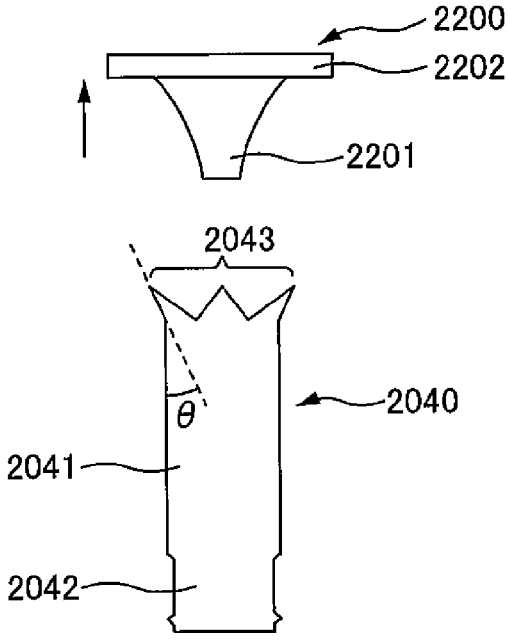

FIG. 25D

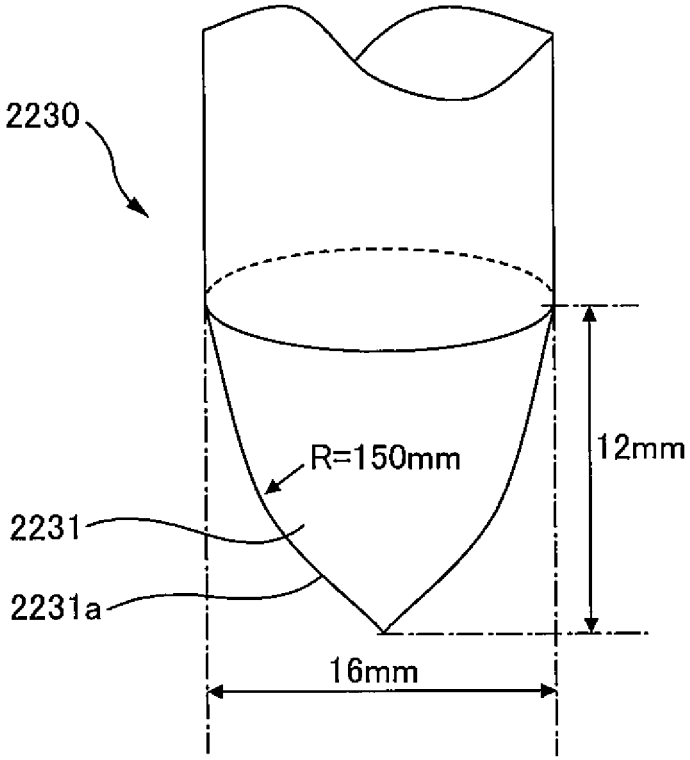

FIG. 26

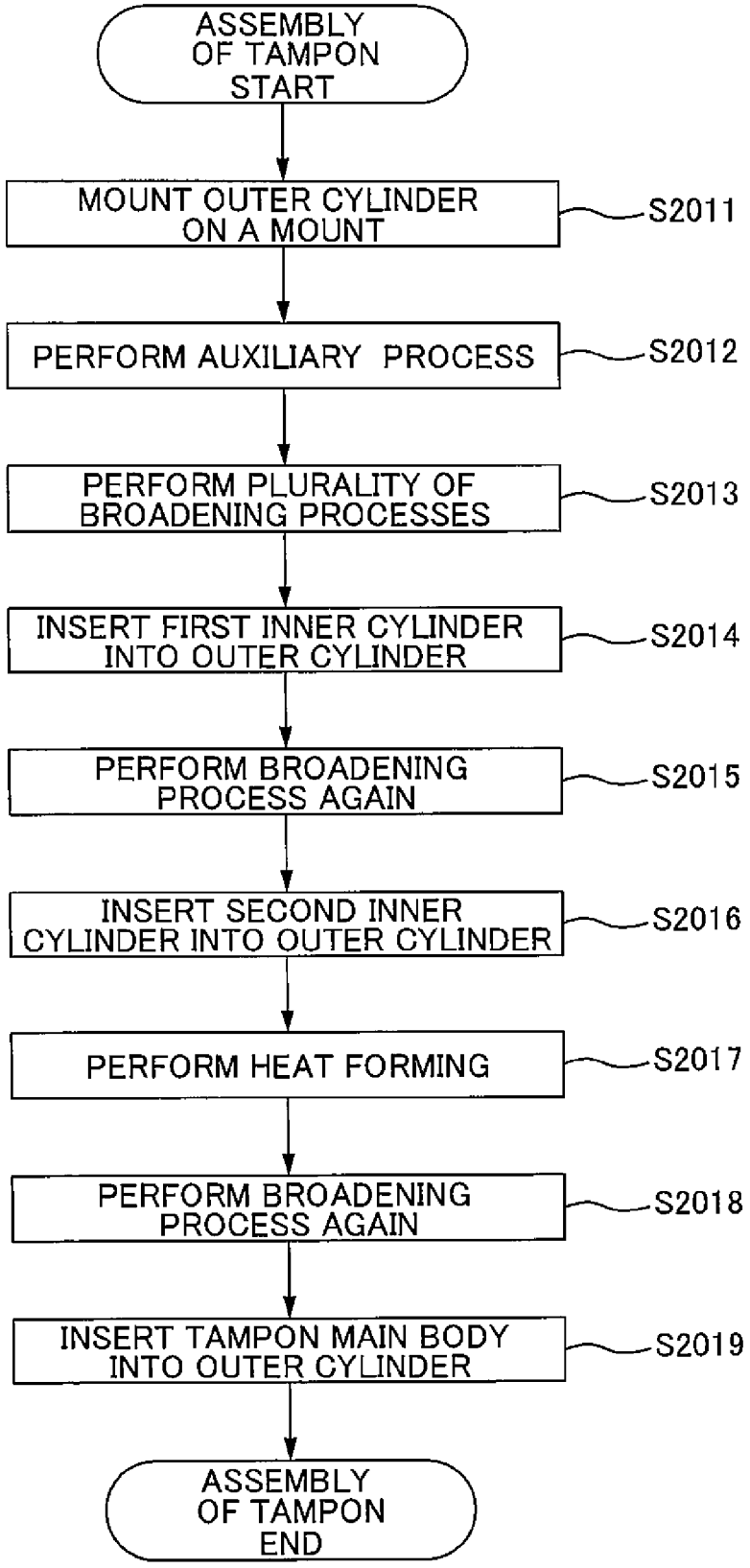
ASSEMBLY OF TAMPON START
MOUNT OUTER CYLINDER ON A MOUNT
S2011
PERFORM AUXILIARY PROCESS
S2012
PERFORM PLURALITY OF BROADENING PROCESSES
S2013
INSERT FIRST INNER CYLINDER INTO OUTER CYLINDER
S2014
PERFORM BROADENING PROCESS AGAIN
S2015
INSERT SECOND INNER CYLINDER INTO OUTER CYLINDER
S2016
PERFORM HEAT FORMING
S2017
PERFORM BROADENING PROCESS AGAIN
S2018
INSERT TAMPON MAIN BODY INTO OUTER CYLINDER
S2019
ASSEMBLY OF TAMPON END

FIG. 27

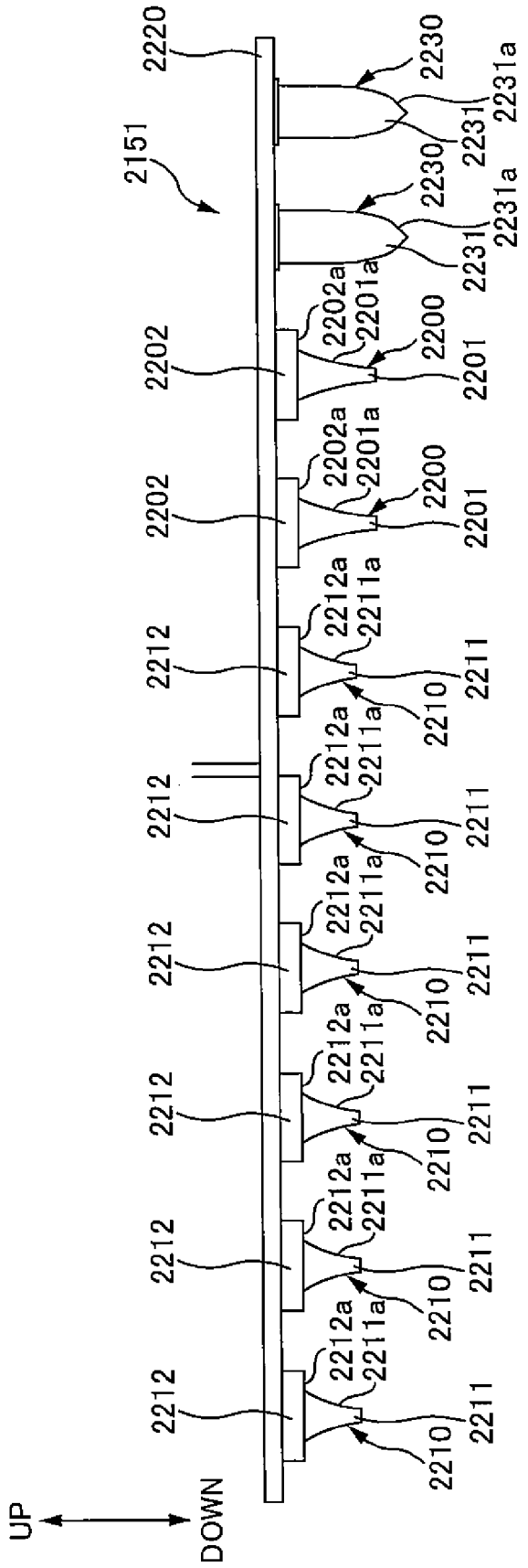
2220
2230
2231a
2231
2151
2230
2231a
2231
2202a
2201a
2202
2200
2201
2202a
2201a
2202
2200
2201
2212a
2211a
2212
2211
2210
2212a
2211a
2212
2211
2210
2212a
2211a
2212
2211
2210
2212a
2211a
2212
2211
2210
2212a
2211a
2212
2211
2210
2212a
2211a
2212
2211
2210
UP
DOWN
TRANSPORT DIRECTION

FIG. 28

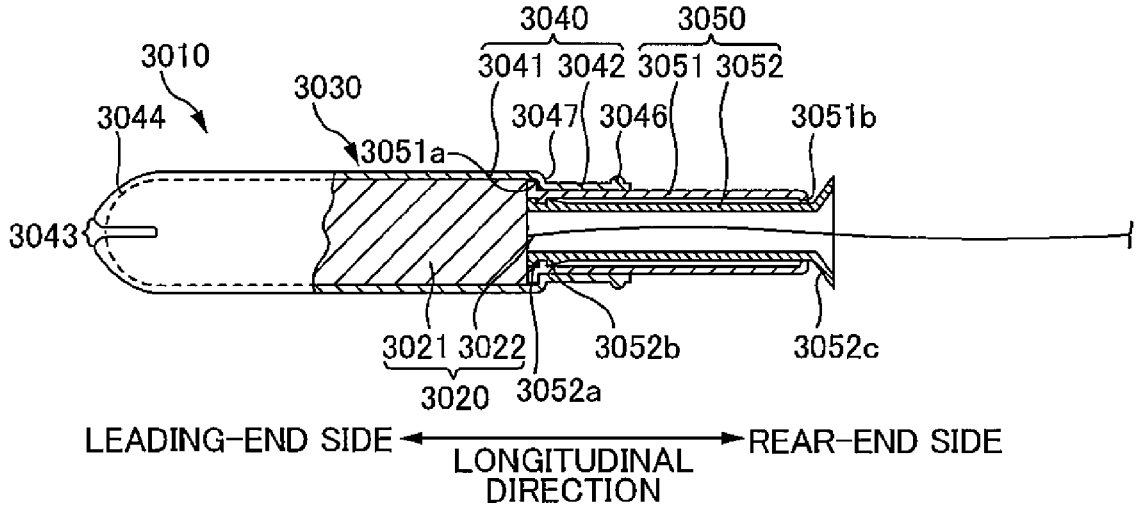

FIG.29

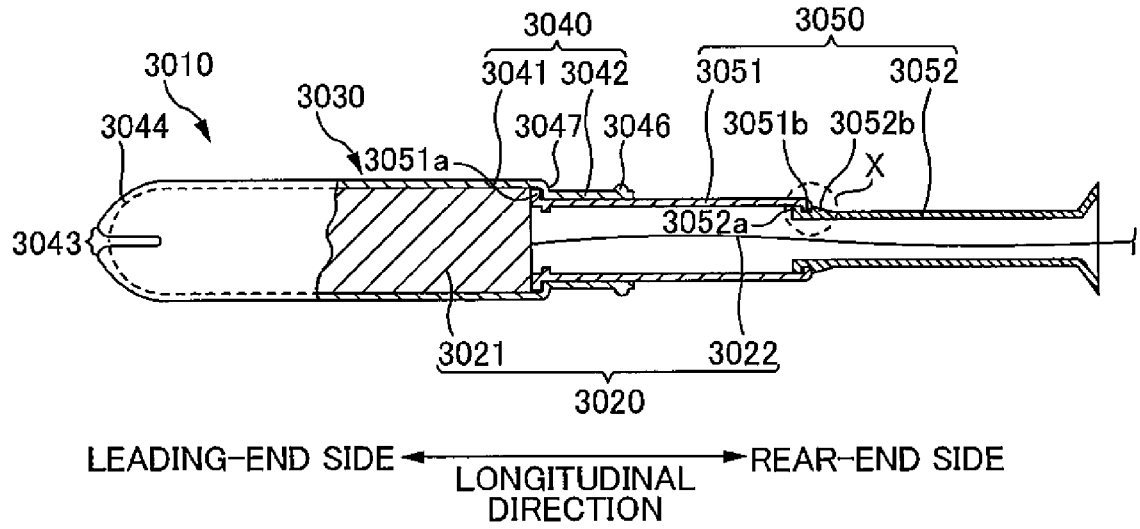

FIG. 30

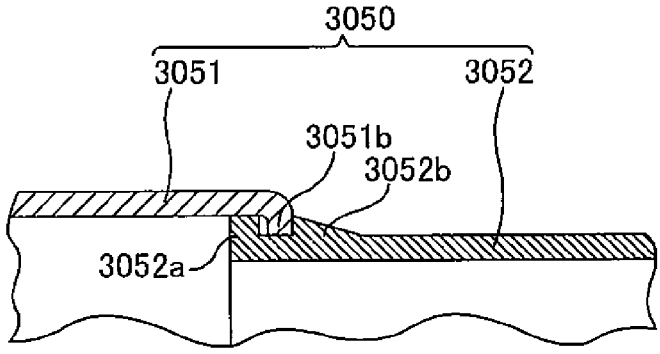

FIG. 31

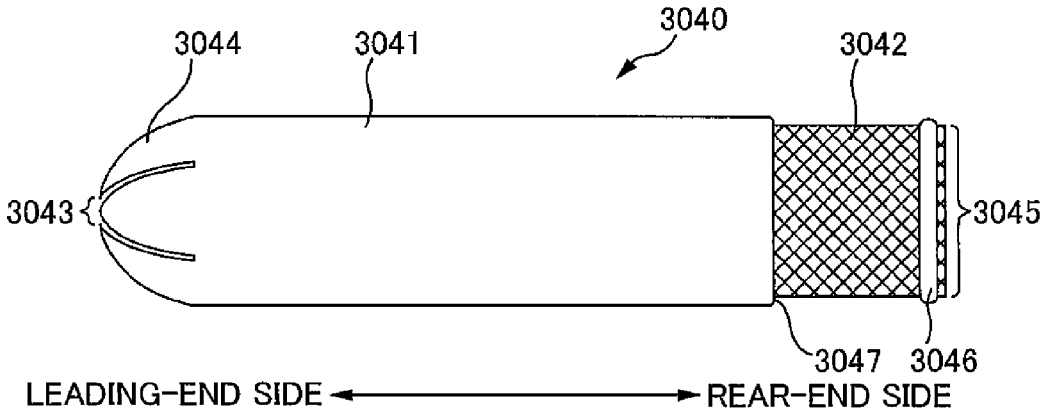

FIG. 32A

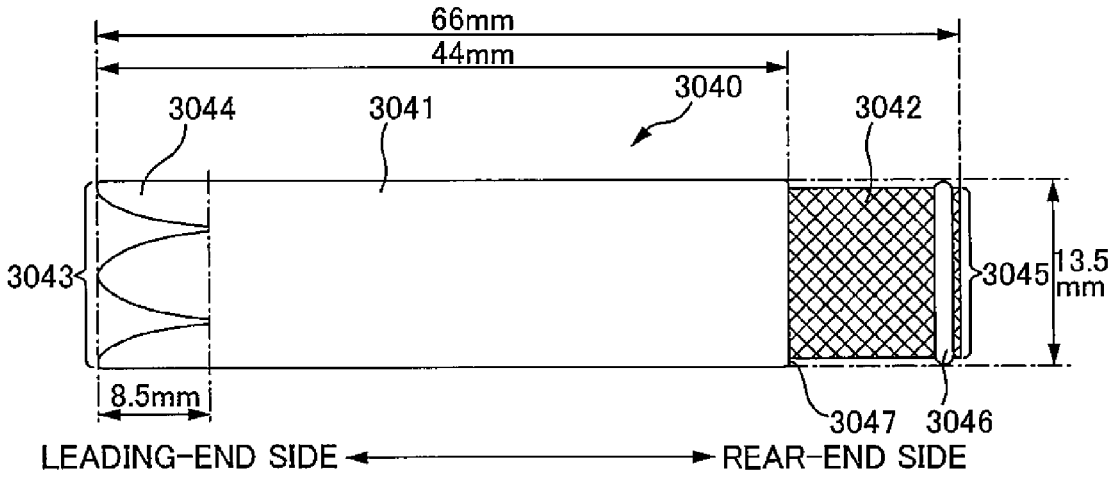

FIG. 32B

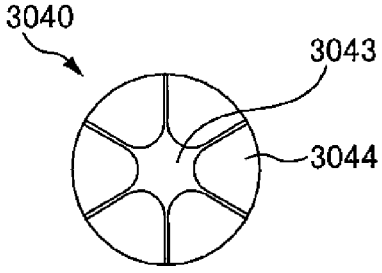

FIG. 32C

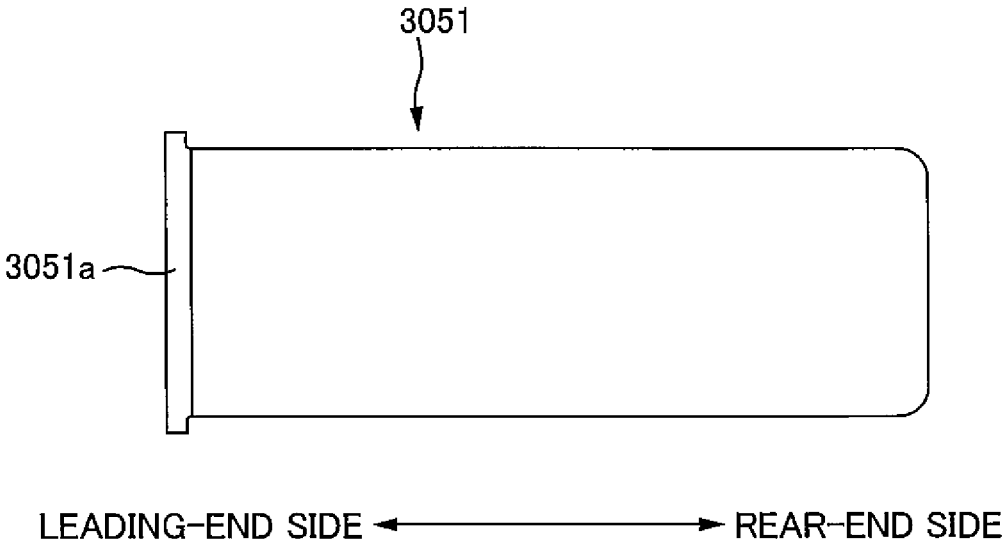
3051
3051a
LEADING-END SIDE
REAR-END SIDE

FIG. 33

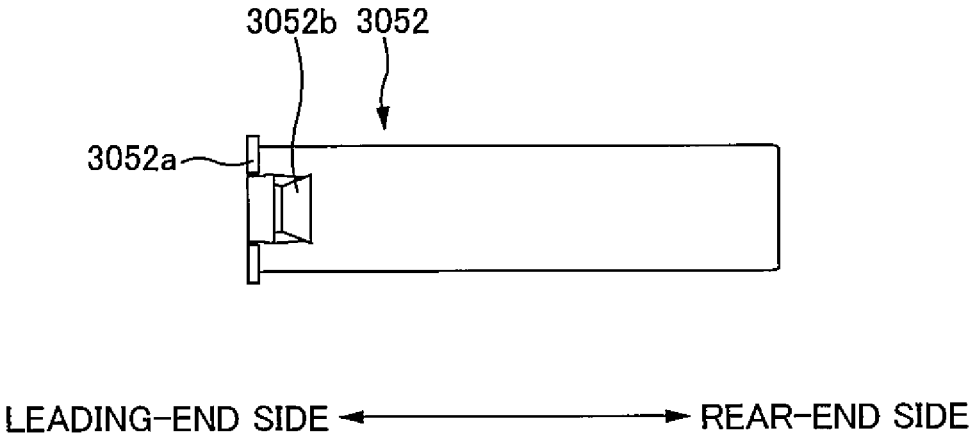
3052b
3052
3052a
LEADING-END SIDE
REAR-END SIDE

FIG. 34

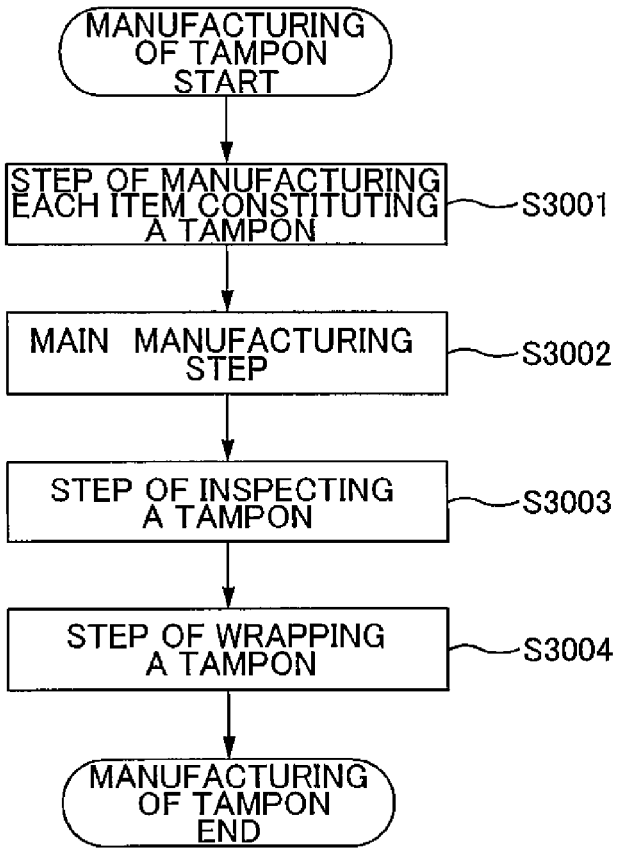

FIG. 35A

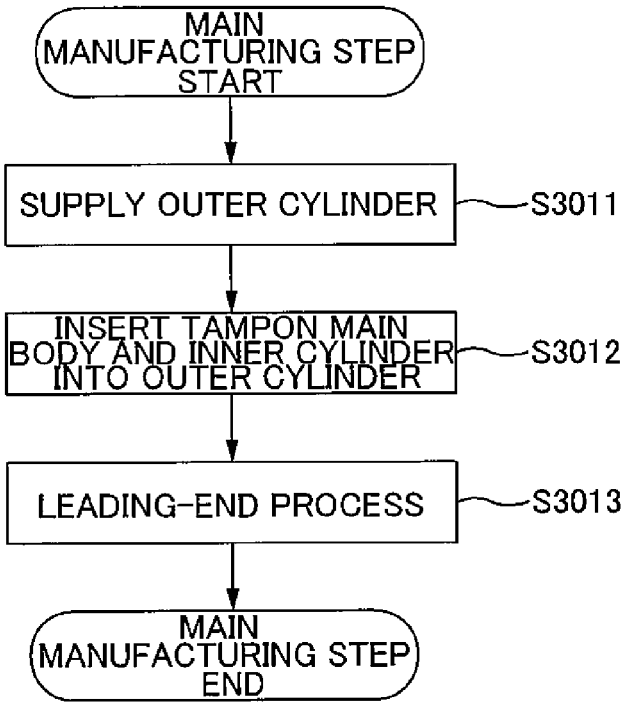

FIG. 35B

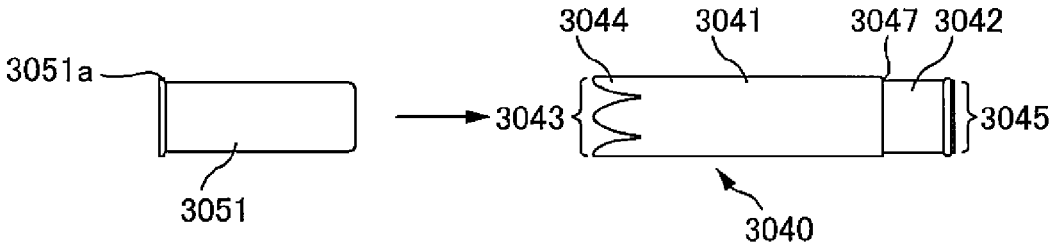

FIG. 36A

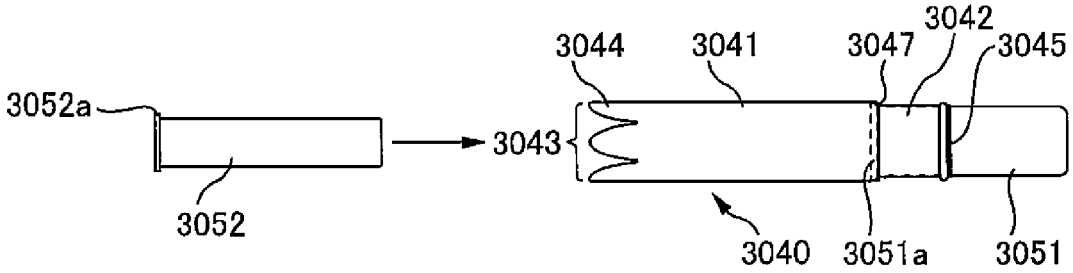

FIG. 36B

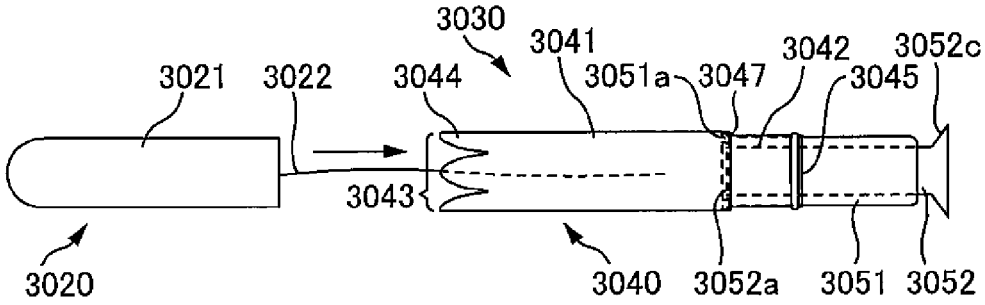

FIG. 36C

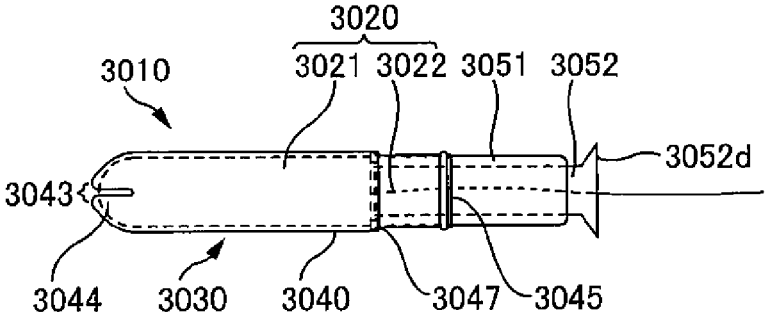

FIG. 36D

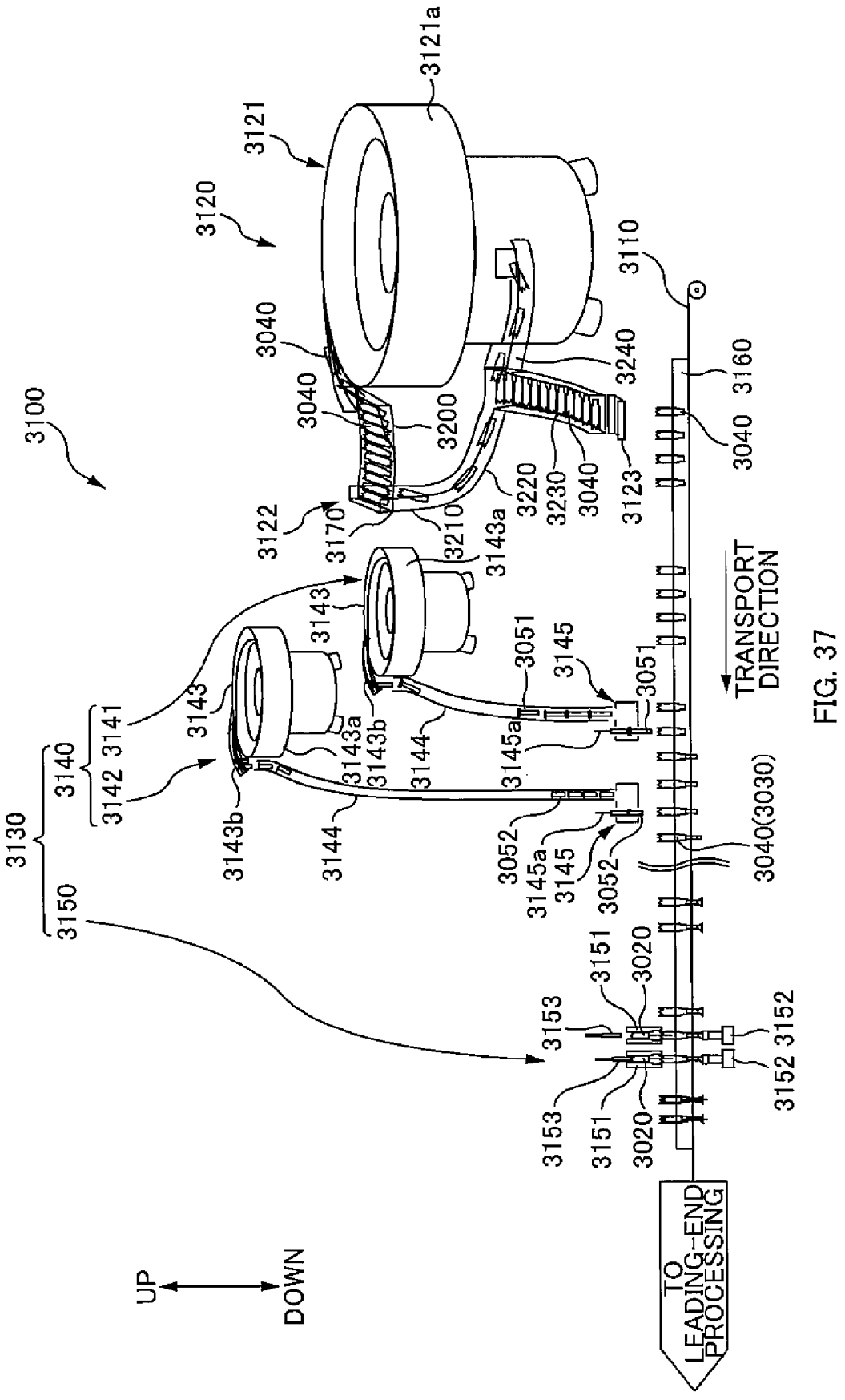
3100
3120
3121
3121a
3110
3040
3240
3160
3200
3123
3122
3170
3210
3220
3230
3143a
3143
3140
3141
3142
3143b
3144
3145
3051
3145a
3052
3130
3150
3153
3151
3020
3152
TRANSPORT DIRECTION
3040(3030)
TO LEADING-END PROCESSING
UP
DOWN

FIG. 37

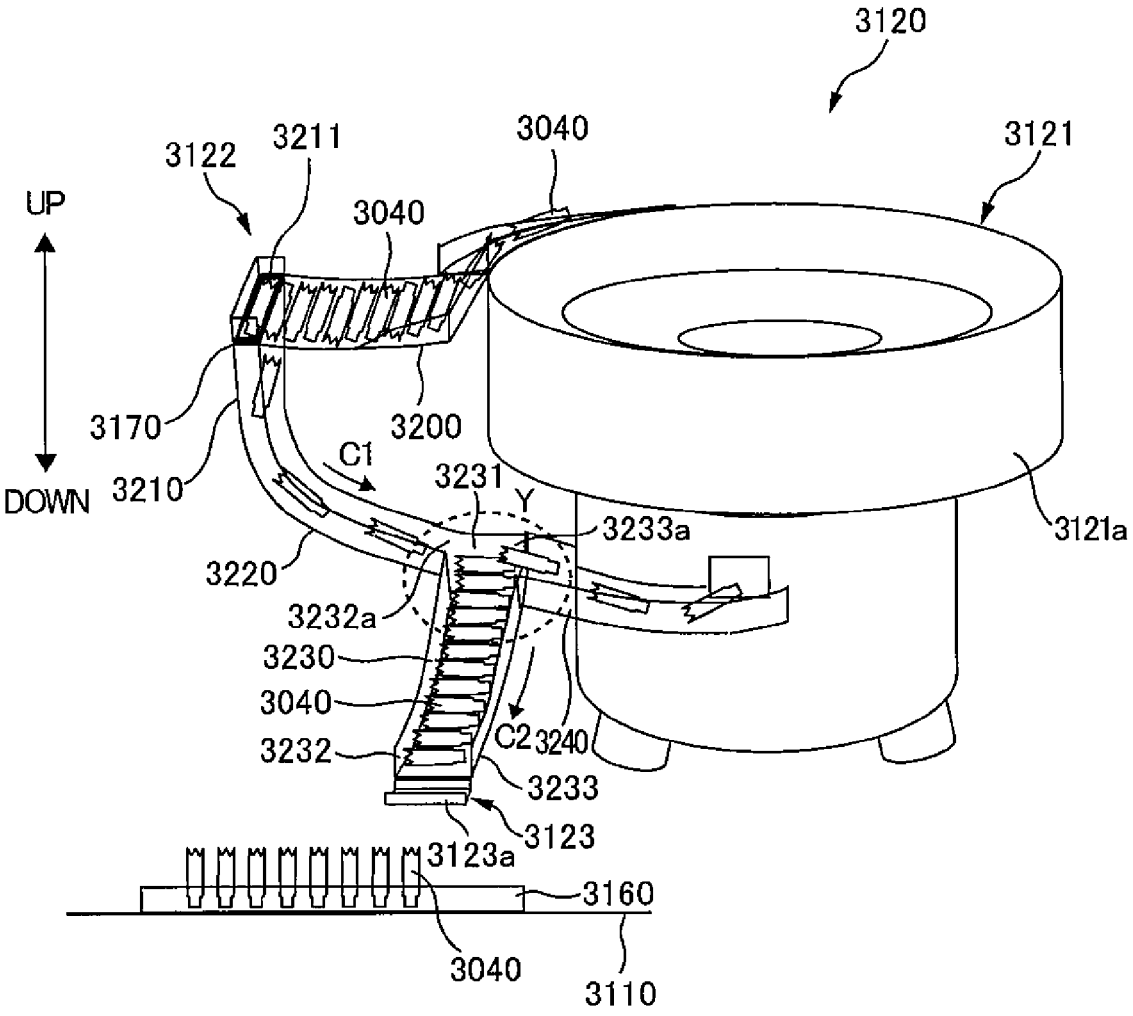
3120
3122
3211
3040
3121
UP
3040
3170
3200
C1
3231
Y
3210
DOWN
3233a
3121a
3220
3232a
3230
3040
C2
3240
3232
3233
3123
3123a
3160
3040
3110

FIG. 38

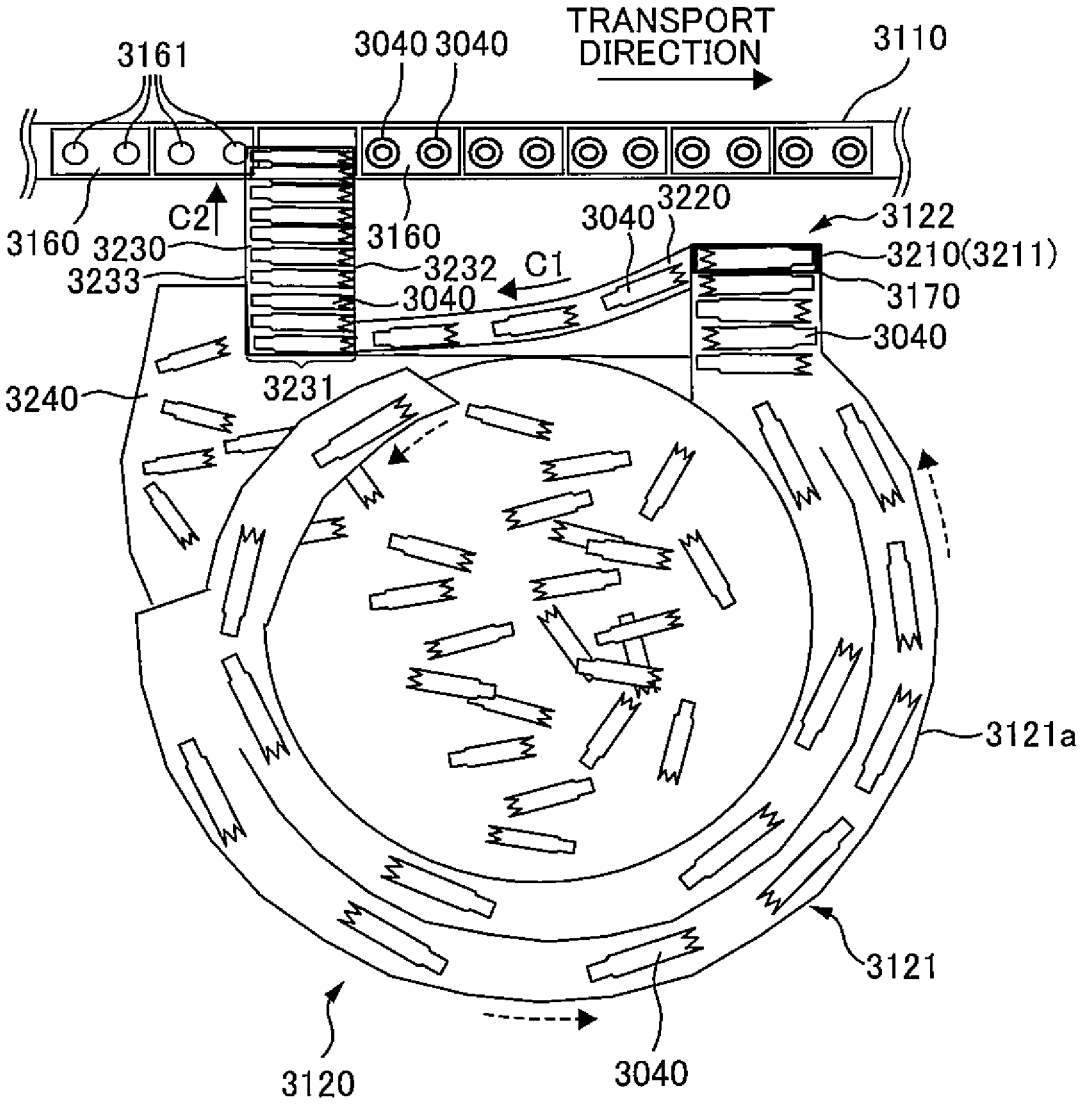
TRANSPORT DIRECTION
3161
3040 3040
3110
3160
C2
3160
3220
3040
3122
3230
3160
3232
C1
3210(3211)
3233
3040
3170
3040
3240
3231
3121a
3121
3120
3040

FIG. 39

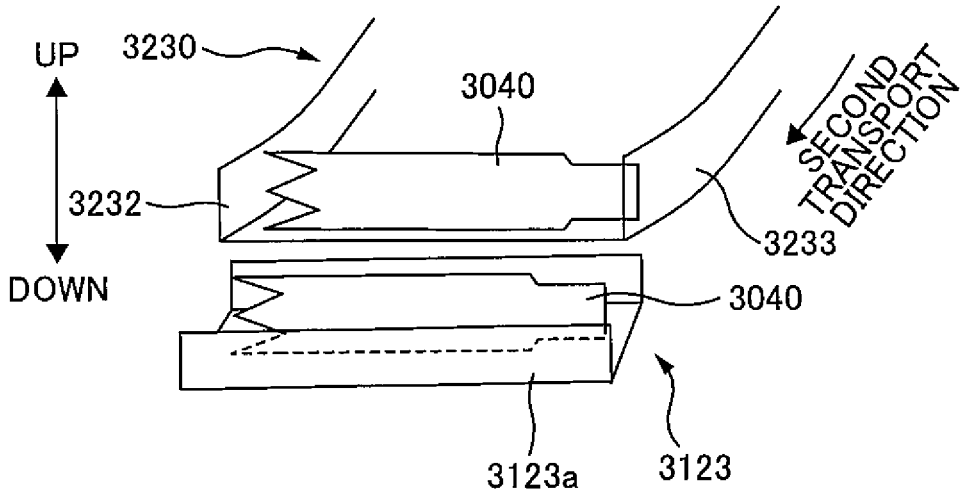

FIG. 40A

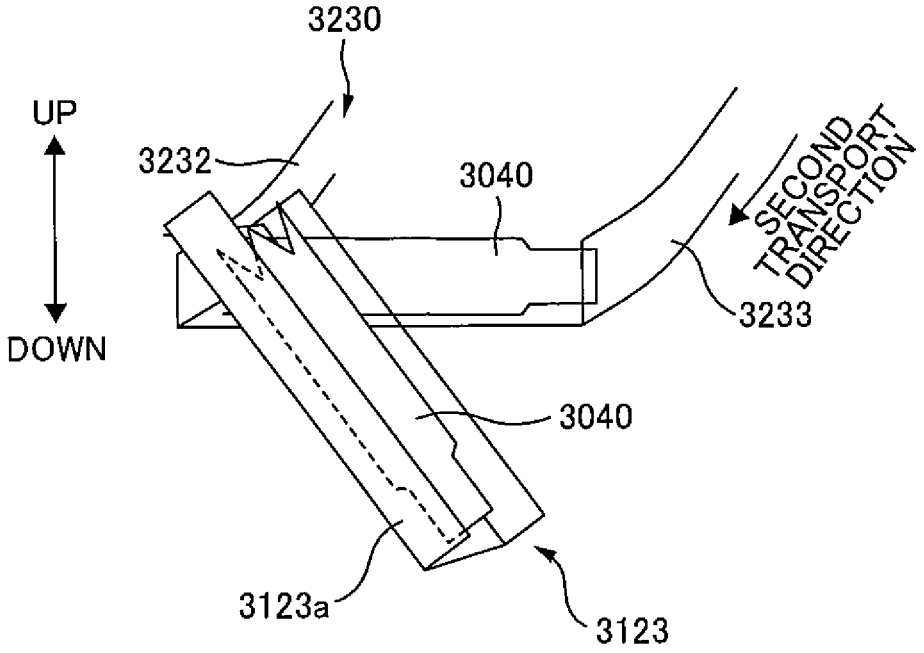

FIG. 40B

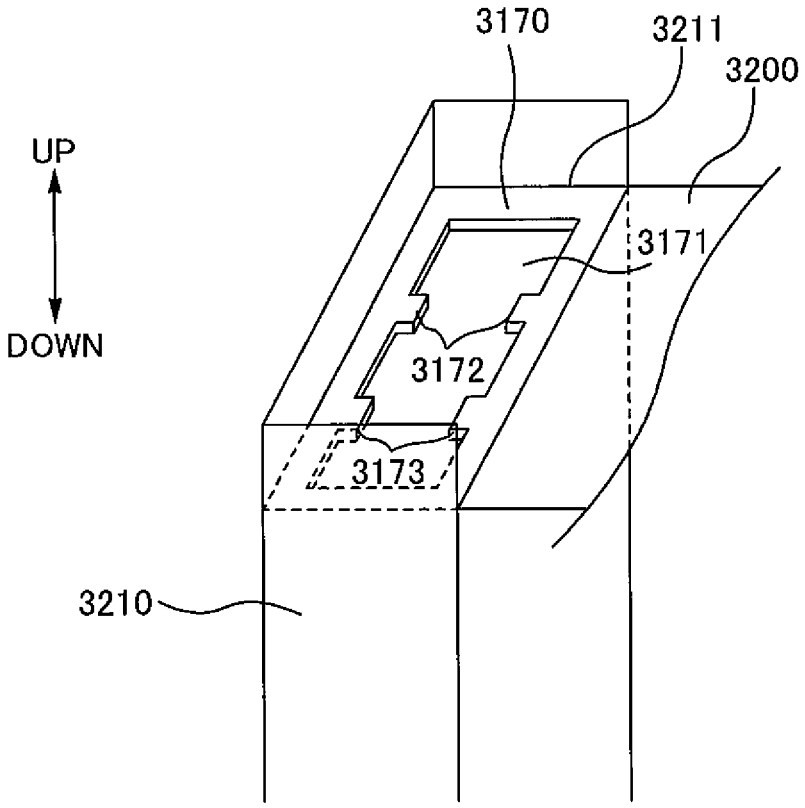

FIG. 41A

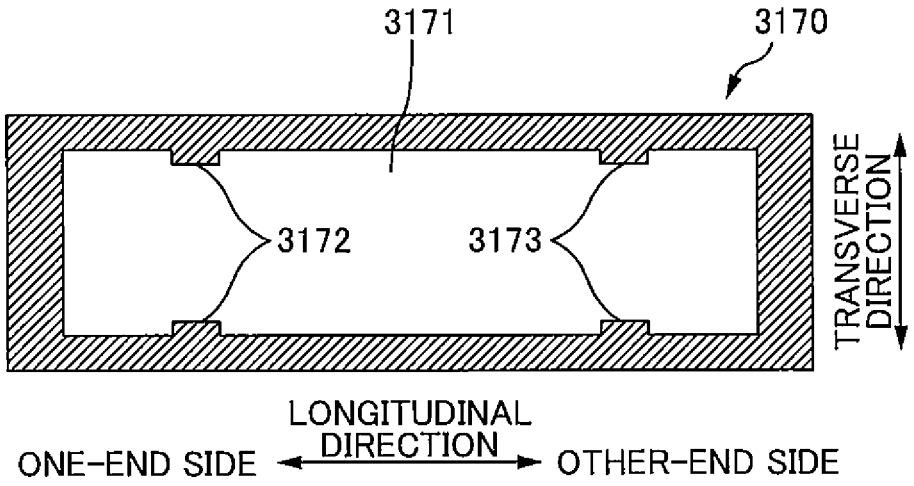

FIG. 41B

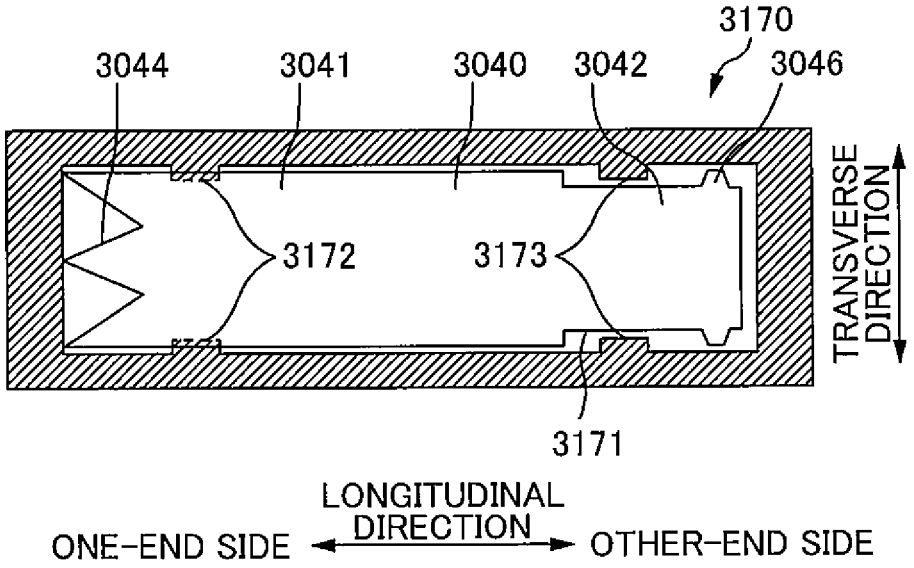

FIG. 41C

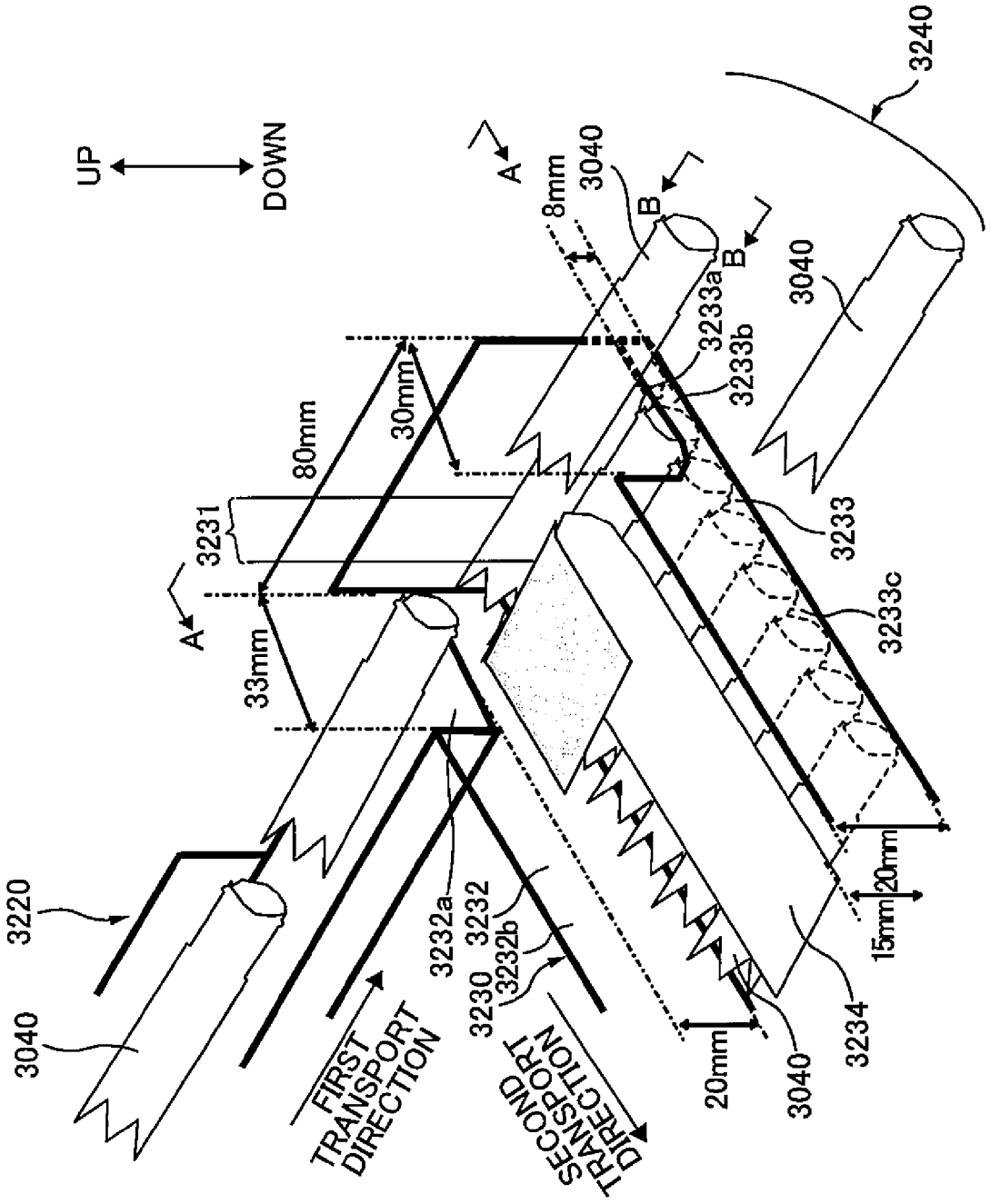
UP
DOWN
A
A
B
B
8mm
3040
3240
3233a
3233b
3040
80mm
30mm
3231
3233
3233c
33mm
3220
3040
3232a
3232
3232b
3230
FIRST TRANSPORT DIRECTION
SECOND TRANSPORTATION DIRECTION
20mm
3040
3234
15mm
20mm

FIG. 42

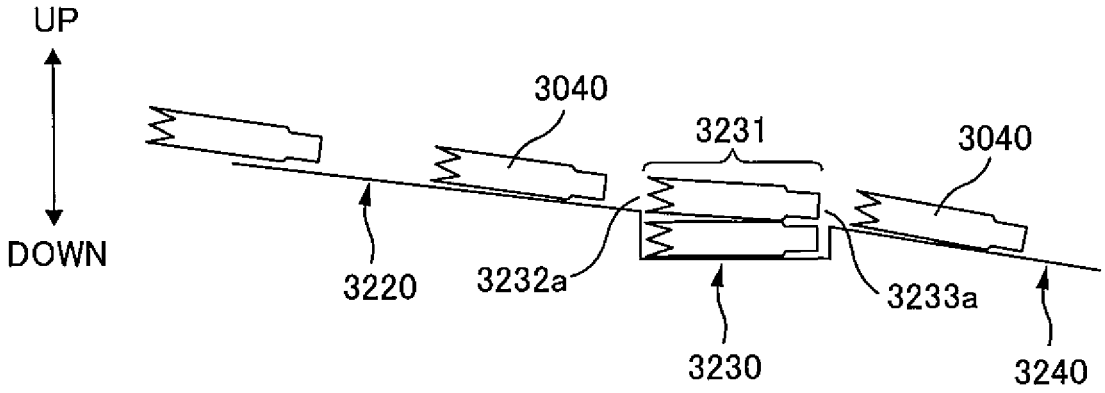

FIG. 43

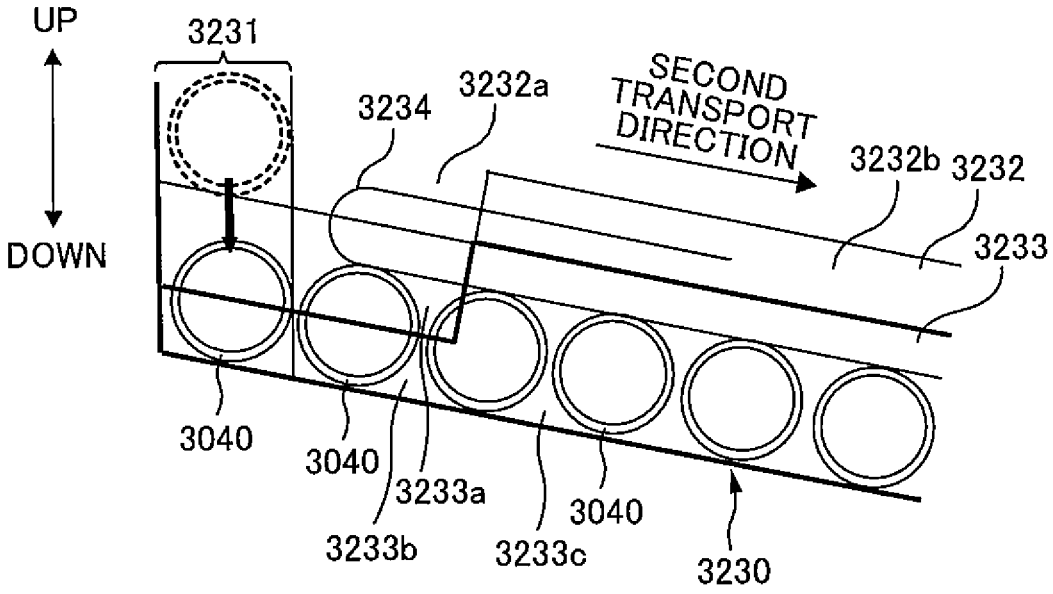

FIG. 44A

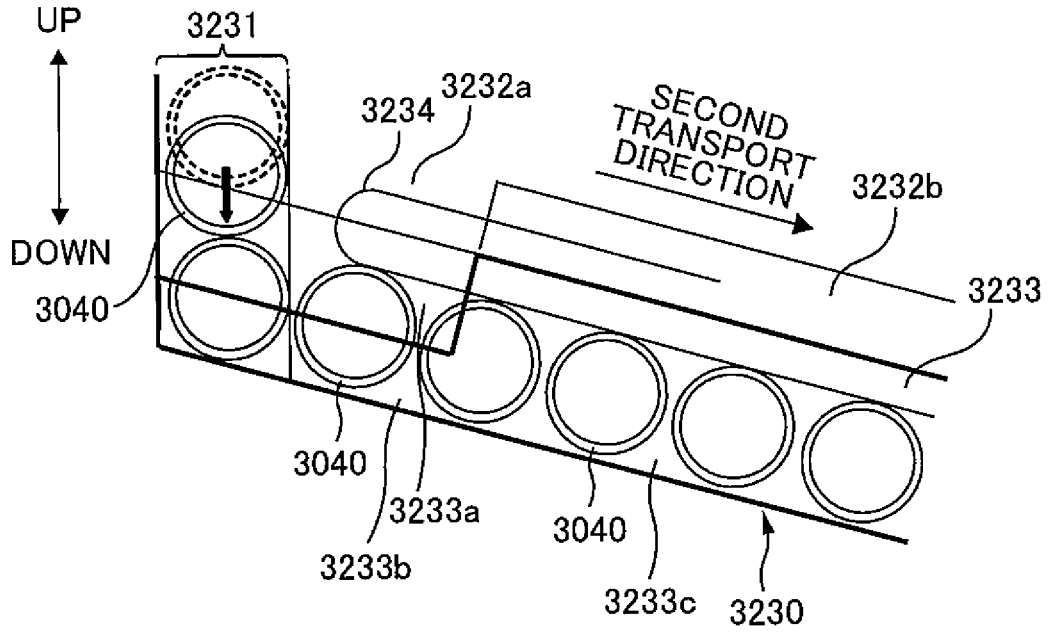

FIG. 44B

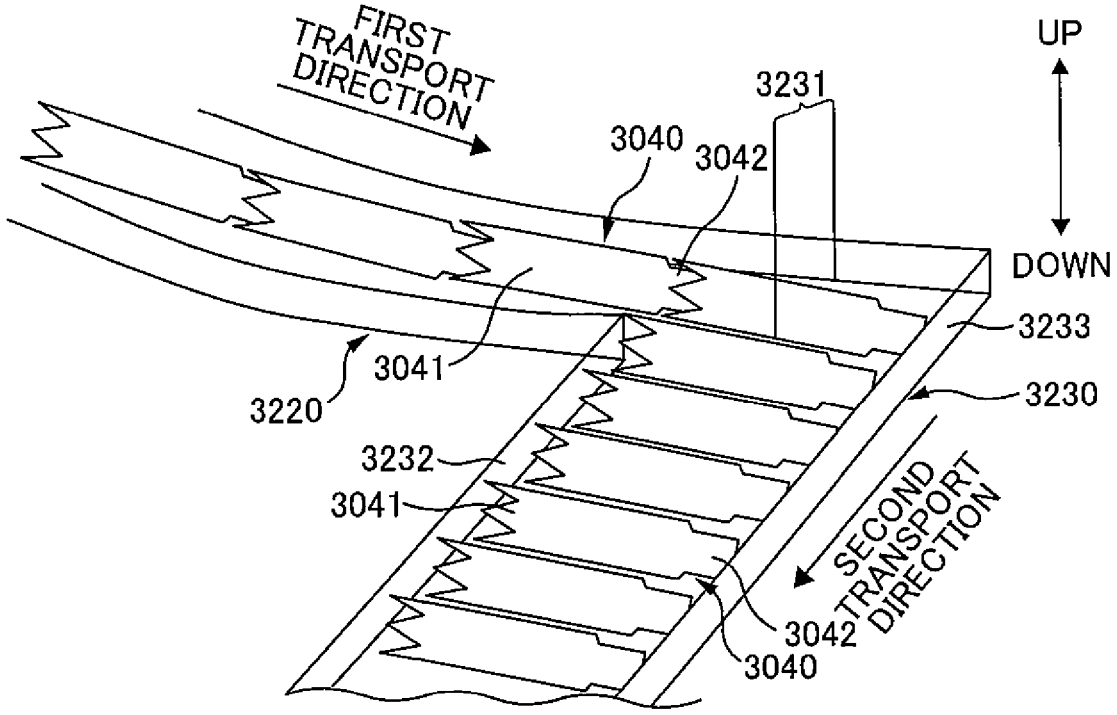
FIRST TRANSPORT DIRECTION
UP
3231
3040
3042
DOWN
3233
3041
3230
3220
3232
3041
SECOND TRANSPORT DIRECTION
3042
3040

FIG. 45

APPARATUS AND METHOD FOR MANUFACTURING A TAMPON

RELATED APPLICATIONS

The present application is a national phase of PCT/JP2009/062938, filed Jul. 17, 2009and is based on, and claims priority from, Japanese Application Number 2008-198349, filed Jul. 31, 2008, Japanese Application Number 2008-222213, filed Aug. 29, 2008, and Japanese Application Number 2008-251447, filed Sep. 29, 2008.

TECHNICAL FIELD

(Part One)

The present invention relates to an apparatus and method for manufacturing a tampon.

(Part Two)

The present invention relates to a method and apparatus for manufacturing a tampon. Particularly, the present invention relates to a method and apparatus for manufacturing a tampon including a tampon main body, an accommodating cylinder accommodating the tampon main body, the accommodating cylinder having an opening formed at a leading end and a plurality of petaloid parts surrounding the opening, and a pushing member that is movable in the accommodating member and pushes the tampon main body out of the accommodating cylinder through the opening.

(Part Three)

The present invention relates to an apparatus and method for manufacturing a tampon. Particularly, the present invention relates to an apparatus and method of manufacturing a tampon including a tampon main body, an accommodating cylinder that accommodates the tampon main body, and a pushing member that moves in the accommodating cylinder and pushes the tampon main body out of the accommodating cylinder, a plurality of petaloid parts being provided at a one-end part in the longitudinal direction of the accommodating cylinder.

BACKGROUND ART

(Part One)

A tampon (sanitary tampon) is known which is inserted into a vaginal cavity in the body and absorbs menstrual blood etc. Such a tampon includes, for example, an absorbent body that absorbs liquid such as menstrual blood, a cylindrical accommodating member that accommodates the absorbent body, and a pushing member that moves inside the accommodating member to push the absorbent body out of the accommodating member. A user of the tampon inserts into the vaginal cavity the accommodating member in which the absorbent body is accommodated and then pushes out the absorbent body using the pushing member. Thus, the absorbent body is guided into the vaginal cavity. Then, the absorbent body that is guided into the vaginal cavity absorbs menstrual blood etc., (see Patent Document 1).

(Part Two)

A tampon including a tampon main body, an accommodating cylinder accommodating the tampon main body, the accommodating cylinder having an opening formed at a leading end and a plurality of petaloid parts surrounding the opening, and a pushing member that is movable in the accommodating member and pushes the tampon main body out of the accommodating cylinder through the opening is widely known as a sanitary product (for example, see Patent Document 1).

A tampon of the above structure is, for example, manufactured by fabricating each item constituting the tampon (i.e., a tampon main body, an accommodating cylinder and a pushing member) and inserting each of the pushing member and the tampon main body into the accommodating cylinder through the opening of the accommodating cylinder.

(Part Three)

A tampon including a tampon main body, an accommodating cylinder that accommodates the tampon main body, and a pushing member that moves in the accommodating cylinder and pushes the tampon main body out of the accommodating cylinder, a plurality of petaloid parts being provided at a one-end part in the longitudinal direction of the accommodating cylinder is widely known as a sanitary product (for example, see Patent Document 1).

The above-mentioned tampon is manufactured by fabricating each of a tampon main body, an above-mentioned and a pushing member that constitutes a tampon and inserting the pushing member and the tampon main body into the accommodating cylinder. Further, a manufacturing apparatus of tampon may include a supplying mechanism that supplies the fabricated accommodating cylinder. The supplying mechanism includes a transport path that transports the accommodating cylinder. As the result of the transportation of the accommodating cylinder by the transport path, the accommodating cylinder is supplied to the predetermined supply destination.

Further, the transport path may include a first transport path that transports the accommodating cylinder in a first transport direction lying along the longitudinal direction of the accommodating cylinder; and a second transport path that receives from the first transport path the accommodating cylinder that has traveled on the first transport path and that transports the accommodating cylinder in a second transport direction intersecting the longitudinal direction of the accommodating cylinder. In such a case, the second transport path includes a receiving part that receives the accommodating cylinder from the first transport path. The accommodating cylinder that has traveled on the first transport path will travel on the second transport path after being received by the receiving part.

RELATED ART DOCUMENTS

Patent Document

Patent document 1: JP-A-05-84263

DISCLOSURE OF INVENTION

Problems to be Solved by the Invention

(Part One)

When manufacturing a tampon of the above-mentioned structure, first, components of the tampon (an absorbent body, an accommodating member and a pushing member) are manufactured. Then, the manufactured components are respectively supplied to a transport conveyor etc., and the pushing member and the absorbent body are inserted into the accommodating member, so as to assemble the tampon. In order to assemble the tampon properly, it is necessary to supply each component to the transport conveyor with the component being oriented in a proper predetermined direction.

In consideration of the operability of the tampon, some type of the above-mentioned accommodating member may include a minor diameter part provided on one end thereof, and a major diameter part provided on the other end thereof

and having an external diameter that is greater than that of the minor diameter part. With the accommodating member of such a structure, it is difficult to orient it in a predetermined direction and thus it is difficult to supply the accommodating member to the transport conveyor accurately and rapidly.

The present invention has been made in view of such a problem and its object is to supply the accommodating member accurately and rapidly while manufacturing a tampon.

(Part Two)

In order to improve production speed of tampons, it is required to insert the tampon main body and the pushing member smoothly into the accommodating cylinder. However, there are cases where the plurality of petaloid parts provided on the accommodating cylinder is inclined inwardly in the radial direction of the accommodating cylinder due to causes such as impaction between accommodating cylinders. With the plurality of petaloid parts being inwardly inclined in the radial direction of the accommodating cylinder, the opening, which serves as an inserting inlet when inserting the tampon main body and the pushing member, is narrowed. Therefore, it will be difficult to insert the tampon main body and the pushing member into the accommodating cylinder.

The present invention has been made in view of such a problem and its object is to insert the tampon main body and the pushing member smoothly into the accommodating cylinder.

(Part Three)

With above-mentioned structure, if the receiving part receives an accommodating cylinder and further receives an accommodating cylinder when the previous accommodating cylinder is already in the receiving part, there is a possibility that the accommodating cylinders will not be supplied properly. Specifically, if the receiving part receives an accommodating cylinder and further receives an accommodating cylinder when the previous accommodating cylinder is already in the receiving part, the accommodating cylinders will not fit into the second transport path.

In detail, if the receiving part tries to further receive accommodating cylinders with the previous accommodating cylinder being already in the receiving part, a plurality of accommodating cylinders will pile up before the receiving part (that is to say, the terminal end part of the first transport path). At this time, the accommodating cylinders piles up in a direction lying along the longitudinal direction of the accommodating cylinders. Regarding the accommodating cylinders which have piled up as has been described above, there may be an accommodating cylinder each of whose petaloid parts being inclined outwards, and the other accommodating cylinder (specifically, the other end part in the longitudinal direction of the other accommodating cylinder) may fit into such an accommodating cylinder. (For example, see FIG. **45**). In other words, if the plurality of accommodating cylinders piles up before the receiving part, the accommodating cylinders may join with each other. Under a situation where the accommodating cylinders are joined with each other, it will be difficult to supply the accommodating cylinders properly.

Accordingly, the present invention has been made in view of such a problem and its object is to supply the accommodating cylinders properly.

Means for Solving the Problems

(Part One)

In order to achieve the objects described above, the main aspect of the present invention is:

an apparatus for manufacturing a tampon, the tampon including an absorbent body that absorbs liquid, an accommodating member that is cylindrical and accommodates the absorbent body, and a pushing member that moves inside the accommodating member and pushes the absorbent body out of the accommodating member, the accommodating member including a minor diameter part provided at a one-end part thereof and a major diameter part provided at an other-end part thereof, the major diameter part having an external diameter greater than that of the minor diameter part, including:

an orienting mechanism that orients the accommodating member;

a first inserting mechanism that inserts the pushing member into the accommodating member oriented by the orienting mechanism; and

a second inserting mechanism that inserts the absorbent body into the accommodating member in which the pushing member is inserted,

the orienting mechanism including:

an opening through which the accommodating member is inputted;

a pair of first protruded parts located on one-end side in a longitudinal direction of the opening and protruding inwardly in an opposing manner into the opening; and

a pair of second protruded parts located on other-end side in the longitudinal direction of the opening and protruding inwardly in an opposing manner into the opening,

a gap between the pair of first protruded parts being greater than the external diameter of the minor diameter part and smaller than the external diameter of the major diameter part, and

a gap between the pair of second protruded parts being greater than the external diameter of the minor diameter part and smaller than the external diameter of the major diameter part.

(Part Two)

In order to achieve the objects described above, the main aspect of the present invention is:

a method of manufacturing a tampon including a tampon main body, an accommodating cylinder accommodating the tampon main body, the accommodating cylinder having an opening formed at a leading end and a plurality of petaloid parts surrounding the opening, and a pushing member that is movable in the accommodating member and pushes the tampon main body out of the accommodating cylinder through the opening, including:

performing a broadening process on the accommodating cylinder, the broadening process broadens the opening by outwardly bending each of the plurality of petaloid parts in the radial direction of the accommodating cylinder;

after performing the broadening process, inserting the pushing member into the accommodating cylinder through the opening; and

after performing the broadening process, inserting the tampon main body into the accommodating cylinder through the opening.

(Part Three)

In order to achieve the objects described above, the main aspect of the present invention is:

an apparatus for manufacturing a tampon including a tampon main body, an accommodating cylinder that accommodates the tampon main body, and a pushing member that moves in the accommodating cylinder and pushes the tampon main body out of the accommodating cylinder, a plurality of petaloid parts being provided at a one-end part in the longitudinal direction of the accommodating cylinder, comprising:

a supplying mechanism that supplies the accommodating cylinder; and

an inserting mechanism that inserts the tampon main body and the pushing member into the accommodating cylinder supplied by the supplying mechanism,

the supplying mechanism including:

a first transport path that transports the accommodating cylinder in a first transport direction lying along the longitudinal direction of the accommodating cylinder; and

a second transport path that transports the accommodating cylinder in a second transport direction intersecting the longitudinal direction of the accommodating cylinder,

the second transport path including:

a receiving part that receives from the first transport path the accommodating cylinder that has traveled on the first transport path;

a side wall formed on an end part opposite to a side where the accommodating cylinder is passed to the receiving part from the first transport path in the first transport direction; and

an outlet formed in the side wall and through which the accommodating cylinder is discharged from the second transport path,

the side wall retains in the receiving part the accommodating cylinder which the receiving part has received when there is no accommodating cylinder in the receiving part, and the accommodating cylinder which the receiving part has received when there is an accommodating cylinder in the receiving part is discharged from the second transport path through the outlet.

Other features of the present invention will become apparent from descriptions of this specification and of accompanying drawings.

Effect of the Invention

(Part One)

According to an aspect of the invention, the accommodating member can be supplied accurately and rapidly while manufacturing a tampon.

(Part Two)

According to an aspect of the invention, the tampon main body and the pushing member can be smoothly inserted into the accommodating cylinder.

(Part Three)

According to an aspect of the invention, the accommodating cylinders can be supplied properly.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1**A is a partial cross-sectional view of a tampon **1001** with an inner cylinder **1020** being contracted.

FIG. **1**B is a partial cross-sectional view of a tampon **1001** with an inner cylinder **1020** being extended.

FIG. **2**A is a flowchart showing the manufacturing of a tampon **1001**.

FIG. **2**B is a diagram showing the details of an assembling step.

FIGS. **3**A to **3**D are diagrams in a series showing the assembling step of a tampon **1001**.

FIG. **4** is a diagram showing an assembling apparatus **1040** of a tampon **1001**.

FIG. **5** is a perspective diagram showing an orienting mechanism **1060** and a neighboring part thereof.

FIG. **6** is a top view showing an orienting plate **1061**.

FIGS. **7**A and **7**B are diagrams showing a positional relationship between an outer cylinder **1011** and an orienting plate **1061** when the outer cylinder **1011** is being inputted into an opening **1062**.

FIGS. **8**A to **8**D are diagrams illustrating the mechanism of orienting an outer cylinder **1011**.

FIG. **9**A is a cross-sectional view of a tampon **1001** of the second embodiment.

FIG. **9**B is an elevation view of an outer cylinder **1011**.

FIG. **10** is a diagram showing a drop chute **1045** of the second embodiment and a neighboring part thereof.

FIG. **11**A is a partial cross-sectional view of the drop chute **1045** viewed in Y-direction shown in FIG. **10**.

FIG. **11**B is a cross-sectional view taken along line X-X in FIG. **10**.

FIG. **12** is a cross-sectional view showing components of a tampon **2010**.

FIG. **13** is a cross-sectional view showing components of a tampon **2010**.

FIG. **14** is a diagram showing how a first inner cylinder **2051** and a second inner cylinder **2052** are joined.

FIG. **15**A is an external view of an outer cylinder **2040**.

FIG. **15**B is an external view of an outer cylinder **2040**.

FIG. **15**C is a diagram showing the outer cylinder **2040** shown in FIG. **15**A from its leading-end side.

FIG. **16** is an external view of the first inner cylinder **2051**.

FIG. **17** is an external view of the second inner cylinder **2052**.

FIG. **18** is a flow chart of the manufacturing of the tampon **2010**.

FIGS. **19**A to **19**D are diagrams in a series showing how the tampon **2010** is manufactured.

FIG. **20** is a diagram showing an assembling apparatus **2100** of the tampon **2010**.

FIG. **21** is a diagram showing a state where the outer cylinder **2040** is mounted on a mount **2160**.

FIG. **22**A is a diagram showing a first pusher unit **2151**.

FIG. **22**B is a diagram showing a second pusher unit **2152**.

FIG. **23** is an external view of a pusher **2200**.

FIG. **24** is an external view of a pusher **2210**.

FIGS. **25**A to **25**D are explanatory diagrams of a broadening process.

FIG. **26** is an external view of an auxiliary pusher **2230**.

FIG. **27** is a flowchart showing the assembling of the tampon **2010**.

FIG. **28** is a diagram showing the structure for simultaneously performing the broadening process on a plurality of outer cylinders **2040**.

FIG. **29** is a cross-sectional view showing components of a tampon **3010**.

FIG. **30** is a cross-sectional view showing components of the tampon **3010**.

FIG. **31** is a diagram showing state in which a first inner cylinder **3051** and a second inner cylinder **3052** are joined.

FIG. **32**A is an external view of an outer cylinder **3040**.

FIG. **32**B is an external view of the outer cylinder **3040**.

FIG. **32**C is a diagram showing the outer cylinder **3040** shown in FIG. **32**A from its leading-end side.

FIG. **33** is an external view of the first inner cylinder **3051**.

FIG. **34** is an external view of the second inner cylinder **3052**.

FIGS. **35**A and **35**B are flowcharts of the manufacturing of the tampon **3010**.

FIGS. **36**A to **36**D are diagrams in a series showing how the tampon **3010** is manufactured.

FIG. **37** is a diagram showing the assembling apparatus **3100** of the tampon **3010**.

FIG. **38** is an enlarged view of a supplying mechanism **3120** shown in FIG. **37**.

FIG. **39** is a top plan view of the supplying mechanism **3120**.

FIGS. **40**A and **40**B are a diagram showing an outer cylinder setting part **3123**.

FIG. **41**A is a diagram showing the position at which an orienting mechanism **3170** is provided.

FIG. **41**B is a plan view of the orienting mechanism **3170**.

FIG. **41**C is a diagram showing how the outer cylinder **3040** passes through a hole **3171** in the orienting mechanism **3170**.

FIG. **42** is an enlarged view of the area labeled "Y" in FIG. **38**.

FIG. **43** is a diagram showing a positional relationship in the vertical direction between a first transport path **3220**, a second transport path **3230** and a third transport path **3240**.

FIGS. **44**A and **44**B are diagrams showing a state how a receiving part **3231** receives the outer cylinder **3040**.

FIG. **45** is a diagram showing the comparison example for explaining the effectiveness of the assembling apparatus **3100** of the present embodiment.

At least the following matters will be disclosed in the present specification and accompanying drawings.

(Part One)

An apparatus for manufacturing a tampon, the tampon including an absorbent body that absorbs liquid, an accommodating member that is cylindrical and accommodates the absorbent body, and a pushing member that moves inside the accommodating member and pushes the absorbent body out of the accommodating member, the accommodating member including a minor diameter part provided at a one-end part thereof and a major diameter part provided at an other-end part thereof, the major diameter part having an external diameter greater than that of the minor diameter part, is provided, which includes:

an orienting mechanism that orients the accommodating member;

a first inserting mechanism that inserts the pushing member into the accommodating member oriented by the orienting mechanism; and

a second inserting mechanism that inserts the absorbent body into the accommodating member in which the pushing member is inserted,

the orienting mechanism including:

an opening through which the accommodating member is inputted;

a pair of first protruded parts located on one-end side in a longitudinal direction of the opening and protruding inwardly in an opposing manner into the opening; and

a pair of second protruded parts located on other-end side in the longitudinal direction of the opening and protruding inwardly in an opposing manner into the opening,

a gap between the pair of first protruded parts being greater than the external diameter of the minor diameter part and smaller than the external diameter of the major diameter part, and

a gap between the pair of second protruded parts being greater than the external diameter of the minor diameter part and smaller than the external diameter of the major diameter part.

With such an apparatus for manufacturing a tampon, since the above-mentioned relationship is established between the major diameter part, the minor diameter part, the gap between the first protruded parts and the gap between the second protruded parts, it becomes easier for the minor diameter part to pass through the opening before the major diameter part. As a result, the accommodating member is automatically oriented and thus the accommodating member can be supplied properly and rapidly.

In the above apparatus for manufacturing a tampon, it is preferable that, with respect to the accommodating member inputted into the opening in such a manner that a longitudinal direction of the accommodating member lies along the longitudinal direction of the opening,

one of the pair of first protruded parts and the pair of second protruded parts is provided at a position at which the minor diameter part passes between the pair of protruded parts; and

the other of the pair of first protruded parts and the pair of second protruded parts is provided at a position at which the major diameter part cannot pass between the pair of protruded parts.

With such an apparatus, since it can effectively prevent the major diameter part from passing through the opening before the minor diameter part, it is facilitated to orient the accommodating member properly.

In the above apparatus for manufacturing a tampon, it is preferable that, with respect to the accommodating member inputted into the opening in such a manner that the longitudinal direction of the accommodating member lies along the longitudinal direction of the opening,

the other of the pair of first protruded parts and the pair of second protruded parts is provided at a position where it comes into contact with a part of the accommodating member that is nearer to the center than the petaloid parts in the longitudinal direction.

With such an apparatus, the petaloid parts do not come into contact with the protruded parts. Therefore, for example, the petaloid parts can be prevented from being deformed and passing between the protruded parts (that is to say, the major diameter part can be prevented from passing between the protruded parts).

In the above apparatus for manufacturing a tampon, it is preferable that,

with respect to the accommodating member inputted into the opening in such a manner that the longitudinal direction of the accommodating member lies along the longitudinal direction of the opening,

the other of the pair of first protruded parts and the pair of second protruded parts is provided at a position where it comes into contact with a part of the accommodating member that is nearer to the petaloid parts than the center of the accommodating member in the longitudinal direction.

With such an apparatus, the part of the accommodating member that comes into contact with the other protruded parts when the accommodating member is inputted in the opening is at leading-end side of the major diameter part. (The accommodating member passes through the opening by rotating around this part). Therefore, thereafter, it becomes easier for the accommodating member to pass through the opening from the leading-end side of the minor diameter part that is on the opposite side. As a result, it becomes easier for the minor diameter part to surely pass through the opening before the major diameter part.

In the above apparatus for manufacturing a tampon, it is preferable that, the accommodating member includes an annular protrusion provided nearer to the end than the minor diameter part;

an external diameter of the annular protrusion being greater than the gap between the pair of first protruded parts and being greater than the gap between the pair of second protruded parts; and

with respect to the accommodating member inputted into the opening in such a manner that the longitudinal direction of the accommodating member lies along the longitudinal direction of the opening,

the one of the pair of first protruded parts and the pair of second protruded parts being provided at a position where it does not come into contact with the annular protrusion.

With such an apparatus, even though an annular protrusion is provided, by providing the protruded parts at positions where they do not come into contact with the annular protrusion, the annular protrusion will not be an obstruction when the minor diameter part passes between the protruded parts. Therefore, it is likely that the minor diameter part will be discharged prior to the major diameter part.

In the above apparatus for manufacturing a tampon, it is preferable that, the orienting mechanism includes:

a first jet part that is provided at a position opposing the first protruded parts and injects air towards the first protruded parts; and

a second jet part that is provided at a position opposing the second protruded parts and injects air towards the second protruded parts.

With such an apparatus, since the time taken for the accommodating member to pass through the opening will be shortened due to the air flow injected by the jet parts, the accommodating member can be supplied more rapidly.

In the above apparatus for manufacturing a tampon, it is preferable that, the apparatus includes:

a transport path that transports the accommodating member and inputs the accommodating member into the opening; and

the transport path inputs the accommodating member into the opening in such a manner that the attitude of the accommodating member, after being inputted, will be such that the major diameter part comes into contact with one of the pair of first protruded parts and the pair of second protruded parts.

With such an apparatus, since the accommodating member comes into contact with the protruded parts when inputted into the opening, even if the major diameter part is inputted into the opening prior to the major diameter part, the minor diameter part will be discharged prior to the major diameter part. Therefore, the accommodating member can be surely oriented.

In the above apparatus for manufacturing a tampon, it is preferable that, the opening is formed in a rectangular shape; and

a distance in the longitudinal direction between an edge on the one-end side in the longitudinal direction of the opening and the first protruded parts is equal to a distance in the longitudinal direction between an edge on the other-end side in the longitudinal direction of the opening and the second protruded parts.

As for the mode of inputting the accommodating member into the opening, there may be a case in which the major diameter part comes into contact with the first protruded parts and a case in which the major diameter part comes into contact with the second protrude parts. According to the apparatus described above, by providing the first protruded parts and the second protruded parts at an equal distance from the edge of the opening in the longitudinal direction, the accommodating member can be properly oriented in both cases.

Further, a method of manufacturing a tampon, the tampon including an absorbent body that absorbs liquid, an accommodating member that is cylindrical and accommodates the absorbent body, and a pushing member that moves inside the accommodating member and pushes the absorbent body out of the accommodating member, the accommodating member including a minor diameter part provided at a one-end part thereof and a major diameter part provided at an other-end part thereof, the major diameter part having an external diameter greater than that of the minor diameter part, is provided, which includes:

orienting, by an orienting mechanism, an orientation of the accommodating member; and

inserting, by an inserting mechanism, the absorbent body and the pushing member into the accommodating member that is oriented by the orienting mechanism,

the orienting mechanism including:

an opening through which the accommodating member is inputted;

a pair of first protruded parts protruding inwardly into the opening; and

a pair of second protruded parts protruding inwardly into the opening;

a gap between the pair of first protruded parts being greater than the external diameter of the minor diameter part and smaller than the external diameter of the major diameter part,

a gap between the pair of second protruded parts being greater than the external diameter of the minor diameter part and smaller than the external diameter of the major diameter part,

the orienting mechanism allowing the minor diameter part of the inputted accommodating member to pass through one of the pair of first protruded parts and the pair of second protruded parts, and not allowing the major diameter part of the inputted accommodating member to pass through the other of the pair of first protruded parts and the pair of second protruded parts, thereby discharging the minor diameter part of the accommodating member before the major diameter part of the accommodating member.

With such a method of manufacturing a tampon, since the minor diameter part is discharged from the opening prior to the major diameter part, the accommodating member is automatically oriented and thus the accommodating member can be supplied properly and rapidly.

—Structure of Tampon with Applicator—

Structure of a tampon with an applicator (hereinafter referred to as a tampon **1001**) will be described with reference to FIGS. **1**A and **1**B. FIG. **1**A is a partial cross-sectional diagram of the tampon **1001** with an inner cylinder **1020** being contracted. FIG. **1**B is a partial cross-sectional diagram of the tampon **1001** with an inner cylinder **1020** being extended. Regarding the longitudinal direction of the tampon **1001** shown in the drawings such as FIG. **1**A, a side that is inserted into a vaginal cavity shall be referred to as a leading-end side and the opposite side shall be referred to as a rear-end side.

The tampon **1001** is a sanitary product including a tampon main body **1004** and an applicator **1010**.

The tampon main body **1004** includes an absorbent body **1005** and a cord **1008**. The absorbent body **1005** is a cotton body that blocks the vaginal cavity and absorbs liquid such as menstrual blood. The absorbent body **1005** is formed by cutting a cotton strip covered with non-woven fabric on both sides and heat forming into a substantially bullet like shape. The cord **1008** is sewn onto the absorbent body **1005** and extends from the rear-end side of the absorbent body **1005**. The cord **1008** is then held by a user when the absorbent body **1005** inside the vaginal cavity is pulled out of the vaginal cavity.

The applicator **1010** is an aid device for guiding the tampon main body **1004** (specifically, the absorbent body **1005**) into the vaginal cavity. The applicator **1010** includes an outer cylinder **1011** which is an example of an accommodating member that is cylindrical and accommodates the absorbent body **1005** and an inner cylinder **1020** which is an example of

a pushing member that moves inside the outer cylinder **1011** and pushes the absorbent body **1005** out of the outer cylinder **1011**.

The outer cylinder **1011** is a cylindrical body formed by injection molding a thermoplastic resin and is flexible. The outer cylinder **1011** includes a minor diameter part **1012** provided at the rear-end part (one-end) and a major diameter part **1013** having an external diameter that is greater than that of a minor diameter part **1012** provided on the leading-end part (the other end). The minor diameter part **1012** is a grip part held by a user when using the tampon **1001**. The major diameter part **1013** is a part which has an internal diameter that is greater than the external diameter of the absorbent body **1005** and which accommodates the absorbent body **1005** therein. When using the tampon **1001**, the major diameter part **1013** is inserted into the vaginal cavity with the absorbent body **1005** being accommodated therein.

The outer cylinder **1011** (specifically, the major diameter part **1013**) includes a leading-end opening **1014** formed at its leading end and a plurality of petaloid parts **1015** surrounding the leading edge opening **1014**. When shipping the tampon **1001**, each of the plurality of petaloid parts **1015** is inwardly bent in an arc in the radial direction of the outer cylinder **1011**. Therefore, when the outer cylinder **1011** is inserted into the vaginal cavity, the leading-end part of the major diameter part **1013** is substantially hemispherical and the leading-end opening **1014** is substantially in a closed position.

Further, the outer cylinder **1011** includes a rear-end opening **1016** formed at its rear end (see FIG. **3**A) and an annular protrusion (annular rib) **1017** provided at a position slightly towards the leading-end side than the rear-end opening **1016** (provided at a position nearer to the rear-end side than the minor diameter part **1012**). Further, an annular stepped part **1018** is formed between the minor diameter part **1012** and the major diameter part **1013**.

The inner cylinder **1020** is a cylindrical body inserted in the minor diameter part **1012**. The inner cylinder **1020** is provided at a position nearer to the rear-end side than the absorbent body **1005** accommodated in the major diameter part **1013** and pushes the absorbent body **1005** from the rear towards the leading-end opening **1014**. Thereby, the absorbent body **1005** (tampon main body **1004**) pushes out each of the plurality of petaloid parts **1015** outwardly in the radial direction of the outer cylinder **1011** and is pushed out of the major diameter part **1013**. The cord **1008** extends through the inner cylinder **1020** and is pulled out from the opening at the rear-end side of the inner cylinder **1020**. It is to be noted that the inner cylinder **1020** of the present embodiment is formed as an extendable two-tier structure. In detail, the inner cylinder **1020** includes a first inner cylinder **1021** and a second inner cylinder **1025** that is slidably inserted in the first inner cylinder.

The first inner cylinder **1021** has an external diameter that is smaller than the internal diameter of the minor diameter part **1012** and is inserted in the minor diameter part **1012**. An annular flange part **1022** is formed on an outer peripheral surface of the leading-end part of the first inner cylinder **1021**. The flange part **1022** has an external diameter that is smaller than the internal diameter of the major diameter part **1013** (greater than the internal diameter of the minor diameter part **1012**) and engages an inner surface of the stepped part **1018** of the outer cylinder **1011**, thereby preventing the inner cylinder **1020** from falling off from the rear-end opening **1016** of the outer cylinder **1011**. Further, at the rear-end side on an inner peripheral surface of the first inner cylinder **1021**, an annular protrusion **1023** extending inwardly in the radial direction is provided.

The second inner cylinder **1025** has an external diameter that is smaller than the internal diameter of the first inner cylinder **1021**. The second inner cylinder **1025** is, when the inner cylinder **1020** is in a contracted state, inserted in the first inner cylinder **1021** as shown in FIG. **1**A and, when the inner cylinder **1020** is in an extended state, connected to the rear-end part of the first inner cylinder **1021** at the leading-end part of the second inner cylinder **1025** as shown in FIG. **1**B. Further, on the outer peripheral surface of the leading-end part of the second inner cylinder **1025**, an arcuate flange part **1026** and a protruded part **1027** provided at a position nearer to the rear-end side than the flange part **1026** is formed. When the annular protrusion **1023** of the first inner cylinder **1021** is at a position between the flange part **1026** and the protruded part **1027** as shown in FIG. **1**B, the protrusion **1023** engages the flange part **1026** and the protruded part **1027**, and thus the first inner cylinder **1021** and the second inner cylinder **1025** are connected. Further, a flared part **1028** is formed at the rear-end part of the second inner cylinder **1025**. The external diameter of the flared part **1028** is greater than the internal diameter of the first inner cylinder **1021**.

—Method of Manufacturing a Tampon **1001**—

FIG. **2**A is a flowchart showing how the tampon **1001** is manufactured. FIG. **2**B is a diagram showing details of the assembling step. FIGS. **3**A to **3**D are diagrams showing the assembling step of the tampon **1001** in a series. In the following description, the method of manufacturing the tampon **1001** will be described step by step (steps S**1010**, S**1020**, S**1030**, S**1040** and S**1050**).

<<Manufacturing Step of Tampon Main Body **1004**: STEP S**1010**>>

First, a cotton strip is covered with non-woven fiber on both surfaces and then the cotton strip is cut. Secondly, a cord is sewn on the cut cotton strip using a sewing thread. Then, the cotton strip on which the cord is sewn is pressed into a substantially bullet-shaped cotton body and then heat formed. In this manner, the tampon main body **1004** having the absorbent body **1005** and the cord **1008** is manufactured.

<<Manufacturing Step of Outer Cylinder **1011** and Inner Cylinder **1020**: STEP S**1020**>>

Using an injection molding machine, the outer cylinder **1011** and the inner cylinder **1020** (the first inner cylinder **1021** and the second inner cylinder **1025**) are each injection molded. The outer cylinder **1011** is injection molded using a thermoplastic resin, for example. It is to be noted that at the time of manufacture, the outer cylinder **1011** is in a state where each of the plurality of petaloid parts **1015** is open, i.e., a leading-end opening **1014** is in an open state (See FIG. **3**A). Also, the flared part **1028** is not formed at the rear-end part of the second inner cylinder **1025** (See FIG. **3**B).

<<Assembling Step of Tampon **1001**: STEP S**1030**>>

The manufactured tampon main body **1004**, the outer cylinder **1011** and the inner cylinder **1020** (the first inner cylinder **1021** and the second inner cylinder **1025**) are assembled by an assembling apparatus **1040** (details will be described later), which is an example of the manufacturing apparatus of the tampon **1001**.

An outline of the assembling of the tampon **1001** will be described.

First, in the assembling apparatus **1040**, the outer cylinder **1011** is supplied to a transport conveyor (step S**1031**). The outer cylinder **1011** that is being supplied is oriented (step S**1032**). Then, as shown in FIG. **3**A, the first inner cylinder **1021** is inserted into the oriented outer cylinder **1011** (step S**1033**). It is to be noted that the first inner cylinder **1021** is inserted into the outer cylinder **1011** through the leading-end opening **1014** thereof. Then, as shown in FIG. **3**B, the second

inner cylinder **1025** is inserted into the outer cylinder **1011** in which the first inner cylinder **1021** is inserted (step S**1034**). In this manner, the applicator **1020** is assembled. Then, as shown in FIG. **3**C, the tampon main body **1004** is inserted into the outer cylinder **1011** (step **1035**). In this step, the cord **1008** is firstly inserted into the outer cylinder **1011**. Thereby, the absorbent body **1005** is accommodated in the major diameter part **1013**.

It is to be noted that in this assembling step, step S**1032** corresponds to the step of orienting the outer cylinder **1011** by the orienting mechanism **1060** (to be described later) and steps S**1033** to S**1035** correspond to the steps of inserting the absorbent body **1005** and the inner cylinder **1020** into the outer cylinder **1011** which has been oriented by the orienting mechanism **1060** by the tampon main body inserting part **1070** (to be described later).

<Structure of Assembling Apparatus **1040**>

The structure of the assembling apparatus **1040** that assembles the tampon **1001** will now be described. FIG. **4** is a diagram showing the assembling apparatus **1040** of the tampon **1001**.

The assembling apparatus **1040** includes an outer cylinder supplying part **1041**, a transport conveyor **1050**, a first inner cylinder supplying part **1051**, a second inner cylinder supplying part **1052** and a tampon main body inserting part **1070**.

The transport conveyor **1050** transports the outer cylinder **1011** and each article (the first inner cylinder **1021**, the second inner cylinder **1025** and the tampon main body **1004**) inserted in the outer cylinder **1011** in a transport direction. A fixing table (not shown) adapted to fix the outer cylinder **1011** is provided on the transport conveyor **1050**. As the fixing table is transported by the transport conveyor **1050**, the outer cylinder **1011** etc., that is fixed on the fixing table is transported in the transport direction.

The outer cylinder supplying part **1041** supplies the outer cylinder **1011** to the transport conveyor **1050**. The outer cylinder supplying part **1041** includes an outer cylinder transport feeder **1042** and a transport path **1043** on which the supplied outer cylinders **1011** are transported.

The outer cylinder transport feeder **1042** is a parts feeder having a bowl-shaped vibratory table **1042***a*. By vibrating the vibratory table **1042***a*, the outer cylinder transport feeder **1042** transports the outer cylinder **1011** to the transport path **1043**.

At a middle part and an end part of the transport path **1043**, accumulating parts **1044** and **1046** are formed that accumulate the outer cylinders **1011** which are being transported primarily in a side-by-side manner. The plurality of outer cylinders **1011** accumulated in the accumulating parts **1044** and **1046** are arranged in a side-by-side manner. Between the accumulating parts **1044** and **1046**, there is provided a drop chute **1045** through which the outer cylinders **1011** drop. At the end of the transport path **1043**, an outer cylinder setting part (not shown) that sets the outer cylinder **1011** accumulated in the accumulating part **1046** on the fixing table of the transport conveyor **1050** is provided. At the inlet of the drop chute **1045**, an orienting mechanism **1060** (details will be described later) that orients the outer cylinder **1011** that is inputted into the drop chute **1045** is provided.

With the outer cylinder supplying part **1041** of such structure, the outer cylinders **1011** transported on the transport path **1043** and accumulated in the accumulating part **1044** drop through the drop chute **1045** sequentially. (During this, the outer cylinders **1011** are oriented). Then, the outer cylinders **1011** that have passed through the drop chute **1045** are accumulated in the accumulating part **1046**. Then, the outer cylinders **1011** accumulated in the accumulating part **1046** are set on the fixing table of the transport conveyor **1050** by the outer cylinder setting part.

The first inner cylinder supplying part **1051** supplies the first inner cylinder **1021** to the transport conveyor **1050**, which first inner cylinder **1021** is to be inserted into the outer cylinder **1011** transported by the transport conveyor **1050**. The first inner cylinder supplying part **1051** includes an inner cylinder transport feeder **1053** and a transport tube **1054**.

The inner cylinder transport feeder **1053** is a parts feeder having a bowl-shaped vibratory table **1053***a*. A pair of rails **1055** forming a part of the transport path of the first inner cylinder **1021** is attached to the inner cylinder transport feeder **1053**. Between the pair of rails **1055**, a space that can hold the first inner cylinder **1021** between the rails **1055** is formed. The flange part **1022** of the first inner cylinder **1021** held in the space engages the top part of the pair of rails **1055** and the first inner cylinder **1021** is transported while being hung down from the pair of rails **1055**.

The first inner cylinder **1021** transported by the pair of rails **1055** drops in the transport tube **1054** with its leading end being located above the rear end. At the end of the transport tube **1054**, an inner cylinder inserting mechanism (not shown) that inserts The first inner cylinder **1021** into the outer cylinder **1011** is provided. When the outer cylinder **1011** that is being transported by the transport conveyor **1050** is located below the inner cylinder inserting mechanism, the inner cylinder inserting mechanism presses the first inner cylinder **1021** dropped in the transport tube **1054** and inserts it into the outer cylinder **1011**. In other words, the first inner cylinder **1021** is inserted into the outer cylinder **1011** as shown in FIG. **3**A. It is to be noted that the transport tube **1054** and the inner cylinder inserting mechanism correspond to the first inserting mechanism.

The second inner cylinder supplying part **1052** supplies the second inner cylinder **1025** to the transport conveyor **1050**, which second inner cylinder **1025** is to be inserted into the outer cylinder **1011** that is being transported with the first inner cylinder **1021** inserted therein. Since the structure of the second inner cylinder supplying part **1052** is similar to that of the first inner cylinder supplying part **1051**, it will not be described here. As shown in FIG. **3**B, the second inner cylinder **1025** is inserted into the outer cylinder **1011** by the second inner cylinder supplying part **1052**.

The tampon main body inserting part **1070** (an example of the second inserting mechanism) inserts the absorbent body **1005** (tampon main body **1004**) into the outer cylinder **1011** in which the first inner cylinder **1021** and the second inner cylinder **1025** are inserted. The tampon main body inserting part **1070** includes a guide part **1071** that guides the insertion of the tampon main body **1004** into the outer cylinder **1011** and a pin **72** that pushes the tampon main body **1004** out of the guide part **1071**. The guide part **1071** further includes a mechanism that holds the tampon main body **1004**. The tampon main body **1004** in the guide part **1071** is held in a state that the cord **1008** is situated below the absorbent body **1005**.

When the outer cylinder **1011** that is being transported by the transport conveyor **1050** is situated below the guide part **1071**, the tampon main body inserting part **1070** pushes the tampon main body **1004** held by the guide part **1071** using the pin **1072**. Thereby, as shown in FIG. **3**C, the tampon main body **1004** is inserted into the outer cylinder **1011**.

By performing the assembling step (step S**1030**) with the assembling apparatus **1040** of the above-mentioned structure, the first inner cylinder **1021**, the second inner cylinder **1025** and the tampon main body **1004** are properly inserted into the outer cylinder **1011**.

<<Processing Step: STEP S1040>>

In this processing step, a bending process for arcuately bending the petaloid parts **1015** in the open state of the outer cylinder **1011** inwardly in the radial direction of the outer cylinder **1011** is performed. It is to be noted that the process of forming the flared part **1028** at the rear-end part of the second inner cylinder **1025** is performed in the assembling step (step S**1030**). With these processes, the tampon **1001** shown in FIG. **3**D is formed.

<<Wrapping Step: STEP S**1050**>>

With the processing of the tampon **1001** is completed, the tampon **1001** is inserted into a wrapper that is formed into a cylindrical shape to wrap the tampon **1001**. Thereafter, a plurality of wrapped tampons **1001** are packed in a box. Thus, the manufacturing of the tampons **1001** is completed and they will be shipped later on.

—Detailed Structure of Orienting Mechanism **1060**—

FIG. **5** is a perspective diagram showing an orienting mechanism **1060** and the neighboring part thereof. FIG. **6** is a top view showing an orienting plate **1061**. FIGS. **7**A and **7**B are diagrams showing a positional relationship between the outer cylinder **1011** and an orienting plate **1061** when the outer cylinder **1011** is being dropped into an opening **1062**.

As shown in FIG. **5**, the orienting mechanism **1060** is provided at the inlet of the drop chute **1045** and includes the orienting plate **1061**, a first jet part **1067** and a second jet part **1068**. In the following description, after describing the structure of the orienting plate **1061**, the structures of a first jet part **1067** and a second jet part **1068** will be described.

<<Structure of the Orienting Plate **1061**>>

The orienting plate **1061** is a rectangular flat plate provided at the inlet of the drop chute **1045**. The outer cylinders **1011** accumulated side-by-side in the accumulating part **1044** are dropped through the orienting plate **1061** and the outer cylinders **1011** are oriented.

As shown in FIG. **6**, the orienting plate **1061** includes an opening **1062** through which the outer cylinder **1011** is inputted and first protruded parts **1063** and second protrude parts **1064** protruding inwardly into the opening **1062**.

The opening **1062** is a rectangular opening and is formed in such a manner that its size is slightly greater that the size of the outer cylinder **1011**. The outer cylinders **1011** that are transported on the transport path **1043** and accumulated in the accumulating part **1044** are inputted into the opening **1062** sequentially. As shown in FIGS. **7**A and **7**B, the outer cylinder **1011** is inputted in such a manner that the longitudinal direction of the outer cylinder **1011** lies along the longitudinal direction of the opening **1062**. For example, among the outer cylinders **1011** accumulated in the accumulating part **1044** shown in FIG. **5**, the outer cylinder **1011** that is at the nearest position to the opening **1062** is inputted as shown in FIG. **7**A and the outer cylinder **1011** that is at the second nearest position to the opening **1062** is inputted as shown in FIG. **7**B.

The first protruded parts **1063** are provided at one end side in the longitudinal direction of the opening **1062** and are a pair of opposing protruded parts. As shown in FIGS. **7**A and **7**B, the gap between the pair of the first protruded part **1063** is greater than the external diameter of the minor diameter part **1012** of the outer cylinder **1011** and is smaller than the external diameter of the major diameter part **1013**. Further, the external diameter of the annular protrusion **1017** of the outer cylinder **1011** is greater than a gap between a pair of first protruded parts **1063**. Therefore, the major diameter part **1013** and the annular protrusion **1017** cannot pass through the pair of first protruded part **1063** and on the other hand the minor diameter part **1012** can pass through the pair of first protruded part **1063**.

The second protruded parts **1064** are provided at the other end side in the longitudinal direction of the opening **1062** and are a pair of opposing protruded parts. Similarly to the first protruded part **1063**, the gap between a pair of the second protruded parts **1064** is greater than the external diameter of the minor diameter part **1012** of the outer cylinder **1011** and is smaller than the external diameter of the major diameter part **1013**. Further, the external diameter of the annular protrusion **1017** of the outer cylinder **1011** is greater than a gap between a pair of first protruded parts **1063**. Therefore, the major diameter part **1013** and the annular protrusion **1017** cannot pass through the pair of first protruded parts **1063** and on the other hand the minor diameter part **1012** can pass through the pair of first protruded part **1063**.

The opening **1062** is divided into three portions by the first protruded parts **1063** and the second protruded parts **1064**. (In other words, it is divided into a one-end opening **1062***a*, a central opening **1062***b* and other-end opening **1062***c*.) The one-end opening **1062***a* is at a location nearer to the one-end side in the longitudinal direction of the opening than the first protruded parts **1063**, the central opening **1062***b* is at a location between the first protruded parts **1063** and the second protruded parts **1064** in the longitudinal direction, and the other end opening **1062***c* is at a position nearer to the other end side than the second protruded part **1064** in the longitudinal direction. The width in the longitudinal direction of the one end opening **1062***a* and the width in longitudinal direction of the other end opening **1062***c* are smaller than the external diameter of the minor diameter part **1012**. On the other hand, the width in longitudinal direction of the central opening **1062***b* is greater than the external diameter of the major diameter part **1013**. The width in longitudinal direction of the one end opening **1062***a* (in other words, the distance between the edge on the one end side of the longitudinal direction of the first end opening **1062***a* and the first protruded parts **1063**) is the same as the width in the longitudinal direction of the other end opening **1062***c* (in other words, the distant between an edge on The opening **1062** other end part in the longitudinal direction and the second protruded parts **1064**).

The positional relationship between the outer cylinder **1011** inputted into the opening **1062** and the first and second protruded parts **1063**, **1064** will now be described.

First, a case in which the outer cylinder **1011** is inputted as shown in FIG. **7**A will be described. With regards to the outer cylinder **1011** inputted into the opening **1062**, among the first protruded parts **1063** and the second protruded parts **1064**, the second protruded parts **1064** are provided at positions where they do not come into contact with the annular protrusion **1017** (specifically, at positions nearer to the center than the annular protrusion **1017** in the longitudinal direction of the opening **1062**.) On the other hand, the first protruded parts **1063** are provided at positions where they come into contact with a part of the outer cylinder **1011** which is nearer to the center than the petaloid parts **1015** in the longitudinal direction (specifically, at a part of the outer cylinder **1011** nearer to the petaloid parts **1015** than the center). Accordingly, the second protruded parts **1064** are provided at positions where the minor diameter part **1012** passes between the pair of second protruded parts **1064** and the first protruded parts **1063** are provided at positions where the major diameter part **1013** cannot pass between the pair of first protruded parts **1063**.

Secondly, a case in which the outer cylinder **1011** is inputted as shown in FIG. **7**B is described. With regards to the outer cylinder **1011** inputted into the opening **1062**, among the first protruded parts **1063** and the second protruded parts **1064**, the

first protruded parts **1063** are provided at positions where they do not come into contact with the annular protrusion **1017** (specifically, at positions nearer to the center than the annular protrusion **1017** in the longitudinal direction of the opening **1062**.) On the other hand, the second protruded parts **1064** are provided at positions where they come into contact with a part of the outer cylinder **1011** which is nearer to the center than the petaloid parts **1015** in the longitudinal direction (specifically, at a part of the outer cylinder **1011** nearer to the petaloid parts **1015** than the center). Accordingly, the first protruded parts **1063** are provided at positions where the minor diameter part **1012** passes between the pair of first protruded parts **1063** and the second protruded parts **1064** are provided at positions where the major diameter part **1013** cannot pass between the pair of second protruded parts **1064**.

By providing the orienting plate **1061** of such a structure, the orientation of the outer cylinder **1011** inputted into the opening **1062** is properly and quickly oriented based on the mechanism of orienting the outer cylinder **1011** to be described later.

<<Structure of First Jet Part **1067** and Second Jet Part **1068**>>

As shown in FIG. **5**, a first jet part **1067** is provided at a position above the orienting plate **1061** and opposing the first protruded parts **1063**. Further, the first jet part **1067** includes a nozzle **1067***a* that injects air and injects air towards the first protruded parts **1063**. In other words, the first jet part **1067** injects air towards the outer cylinder **1011** inputted into the opening **1062** (in the case of FIG. **7**A, towards the major diameter part **1013**).

The second jet part **1068** is provided at a position above the orienting plate **1061** and opposing the second protruded parts **1064**. Further, the second jet part **1068** includes a nozzle **1068***a* that injects air and injects the air towards the second protruded parts **1064**. In other words, the second jet part **1068** injects the air towards the outer cylinder **1011** inputted into the opening **1062** (in the case of FIG. **7**A, towards the minor diameter part **1012**).

Because the first jet part **1067** and the second jet part **1068** inject air towards the outer cylinder **1011** inputted into the opening **1062**, the time taken for the outer cylinder **1011** to pass through the opening **1062** (drop chute **1045**) can be shortened and the supply speed of the outer cylinder **1011** can be increased. It is to be noted that during the supply of outer cylinder **1011**, the first jet part **1067** and the second jet part **1068** inject air continuously. Of course, air can be intermittently injected in accordance with the dropping timing of the outer cylinder **1011** into the opening **1062**.

—Mechanism of Orienting the Outer Cylinder **1011** Using the Orienting Mechanism **1060**—

As has been described above, the outer cylinder **1011** is inputted into the opening **1062** with one of the two modes shown in FIGS. **7**A and **7**B. Since the mechanism for orienting the outer cylinder **1011** inputted as shown in FIG. **7**A and the mechanism for orienting the outer cylinder **1011** inputted as shown in FIG. **7**B are similar, the following description will be made with reference to the mechanism of orienting the outer cylinder **1011** that is inputted as shown in FIG. **7**A.

FIGS. **8**A to **8**D are diagrams illustrating the mechanism of orienting the outer cylinder **1011**.

FIG. **8**A shows how the outer cylinder **1011** accumulated side-by-side in the accumulating part **1044** is inputted into the opening **1062** in the orienting plate **1061** in a state shortly before the outer cylinder **1011** is inputted into the opening **1062**. The outer cylinder **1011** is inputted into the opening **1062** with an attitude such that the major diameter part **1013** comes into contact with the pair of first protruded parts **1063** after being inputted. In detail, the outer cylinder **1011** is inputted in such a manner that the outer cylinder **1011** and the opening **1062** are in parallel. Therefore, since the minor diameter part **1012** and the major diameter part **1013** of the outer cylinder **1011** are inputted into the opening **1062** substantially at the same time, the subsequent orienting can be performed properly.

The major diameter part **1013** of the outer cylinder **1011** that is inputted comes into contact with the first protruded parts **1063** as shown in FIG. **8**B, since the external diameter of the major diameter part **1013** is greater than the gap between the pair of first protruded parts **1063**. In other words, the major diameter part **1013** does not pass between the first protruded parts **1063**. It is to be noted that because the first protruded parts **1063** come into contact with a part of the major diameter part **1013** nearer to the center than the petaloid parts **1015** in the longitudinal direction, the petaloid parts **1015** can be prevented from being deformed by coming into contact with the first protruded parts **1063** and passing between the first protruded parts **1063**.

On the other hand, since the external diameter of the minor diameter part **1012** is smaller than the gap between the pair of second protruded parts **1064**, the minor diameter part **1012** of the outer cylinder **1011** starts passing between the pair of second protruded parts **1064** as shown in FIG. **8**B. It is to be noted that because the first protruded parts **1063** come into contact with a part of the outer cylinder **1011** nearer to the petaloid parts **1015** than the center, it is likely to drop from the leading-end side of the minor diameter part **1012** on the opposite side. As a result, it is easier for the minor diameter part **1012** to pass between the second protruded parts **1064**.

Also, when the minor diameter part **1012** passes between the second protruded parts **1064**, the annular protrusion **1017** of the outer cylinder **1011** starts passing the other-end opening **1062***c*. That is to say, the annular protrusion **1017** does not obstruct the passage of the minor diameter part **1012** through the opening **1062** because the annular protrusion **1017** is at a position that does not come into contact with the second protruded parts **1064**. Further, since the second jet part **1068** opposing the second protruded parts **1064** injects air towards the minor diameter part **1012**, the speed at which the minor diameter part **1012** passes between the pair of second protruded parts **1064** increases.

Also after the minor diameter part **1012** has started passing between the second protruded parts **1064**, while major diameter part **1013** remains in contact with the first protruded parts **1063** (i.e., a state in which the major diameter part **1013** does not pass between the pair of first protruded parts **1063**), the minor diameter part **1012** drops between the pair of second protruded parts **1064** (the minor diameter part **1012** rotates about a part at which the major diameter part **1013** is in contact with the first protruded parts **1063**). Thus, the minor diameter part **1012** completely passes between the pair of second protruded parts **1064** as shown in FIG. **8**C. At this point, the major diameter part **1013** starts passing through the central opening **1062***b*.

In this manner, the major diameter part **1013** completely passes through the central opening **1062***c* and the outer cylinder **1011** is discharged from the orienting plate **1061** as shown in FIG. **8**D. The plurality of outer cylinders **1011** accumulated side-by-side in the accumulating part **1044** are sequentially inputted into the opening **1062** and each of the outer cylinders **1011** discharged from the opening **1062** is oriented in a manner described below. That is to say, as shown in FIG. **8**D, the outer cylinder **1011** is oriented in such a manner that its major diameter part **1013** is at an upper position and the minor diameter part **1012** is at a lower position.

(In other words, it is oriented in such a manner that the minor diameter part **1012** drops first).

It is to be noted that also for the outer cylinder **1011** that is dropped in a manner shown in FIG. **7**B, the outer cylinder **1011** is oriented by a similar mechanism. That is to say, the outer cylinder **1011** is oriented in such a manner that the minor diameter part **1012** drops first.

In this manner, the orienting mechanism **1060** discharges the minor diameter part **1012** of the outer cylinder **1011** prior to the major diameter part **1013** by allowing the minor diameter part **1012** of the outer cylinder **1011** that has been inputted to pass between one of the pair of first protruded parts **1063** and the pair of the second protruded parts **1064** while not allowing the major diameter part **1013** of the outer cylinder **1011** that has been inputted to pass between the other of the pair of first protruded parts **1063** and the pair of the second protruded parts **1064**.

<<Effectiveness of Assembling Apparatus **1040** and Manufacturing Method of the Present Embodiment>>

As has been described above and as shown in FIG. **5**, the orienting mechanism **1060** includes the opening **1062** through which the outer cylinder **1011** is inputted, the pair of first protruded parts **1063** and the pair of second protruded parts **1064** protruding inwardly into the opening **1062**. The gap between the pair of first protruded parts **1063** and the gap between the pair of second protruded parts **1064** are each greater than the external diameter of the minor diameter part **1012** of the outer cylinder **1011** and smaller than the external diameter of the major diameter part **1013**. Thus, the outer cylinder **1011** can be supplied properly and rapidly when manufacturing the tampon **1001**.

In the following description, the effectiveness of the present embodiment will be described with reference to two comparison examples.

Firstly, in comparison example 1, the orientation of the outer cylinder **1011** that is being transported in the transport path is determined based on video signals obtained by imaging the outer cylinder **1011** using camera etc., having an image sensor. Then, the outer cylinder **1011** is oriented by using a turning device to change the orientation in such a manner that the outer cylinder **1011** is oriented in a predetermined orientation. However, in the case of comparison example 1, a complicated structure is required and it is likely that a longer time will be needed to orient the outer cylinder **1011**.

In comparison example 2, the outer cylinder **1011** is sent to a device which fits with the major diameter part **1013** but does not fit with the minor diameter part **1012**. Then, the outer cylinder **1011** is oriented by discharging only the outer cylinder **1011** that was sent in the orientation which does not fit. However, in the case of comparison example 2, since the major diameter part **1013** includes the petaloid parts **1015**, it is difficult to fit the major diameter part **1013** in a proper manner. As a result, there is a possibility that the outer cylinder **1011** is falsely discharged. Also, since the outer cylinder **1011** is discharged, the supply efficiency of the outer cylinder **1011** is decreased.

On the other hand, in the present embodiment, since the above-mentioned relationship holds between the external diameter of the minor diameter part **1012**, the external diameter of the major diameter part **1013**, the gap between the first protruded parts **1063** and the gap between the second protruded parts **1064**, it is easier for the minor diameter part **1012** to firstly pass through the gaps between one of the first protruded parts **1063** and the second protruded parts **1064**. Specifically, as shown in FIGS. **8**A to **8**D, for example, the orienting mechanism **1060** allows the minor diameter part **1012** of the outer cylinder **1011** that has been inputted to pass between the pair of second protruded parts **1064** and does not allow the major diameter part **1013** to pass between the pair of first protruded parts **1063**. Accordingly, the minor diameter part **1012** of the outer cylinder **1011** is discharged prior to the major diameter part **1013**. Thus, the outer cylinder **1011** that drops in the drop chute **45** simply passes through the orienting plate **1061** and then the outer cylinder **1011** is oriented automatically. As a result, the outer cylinder **1011** can be supplied rapidly as compared to comparison example 1. Also, the structure can be simplified as compared to comparison example 1. Further, since the orientation of all outer cylinders **1011** that drops into the drop chute **1045** can be oriented, the supply efficiency can be raised as compared to comparison example 2.

Based on the above, according to the assembling apparatus **1040** and manufacturing method of the tampon **1001** of the present embodiment, upon manufacturing the tampon **1001**, the outer cylinder **1011** can be supplied to the transport conveyor **1050** properly and rapidly.

—Second Embodiment—

A second embodiment that has a different structure from the above-described embodiment (first embodiment) will now be described. In the following description, the structure of a tampon **1001** of the second embodiment and the manufacturing method and assembling apparatus **1040** of the above-mentioned tampon **1001** will be described. It is to be noted that the structure whose description is omitted is similar to that of the first embodiment.

<<Structure of Tampon **1001**>>

FIG. **9**A is a cross-sectional view of a tampon **1001** of the second embodiment. FIG. **9**B is an elevation view of an outer cylinder **1011**. The tampon **1001** of the second embodiment has an external diameter smaller than that of the tampon **1001** of the first embodiment (FIG. **1**A) and is designed to achieve an easier insertion into a vaginal cavity.

As shown in FIG. **9**A, the tampon **1001** includes a tampon main body **1004** and an applicator **1010**. The tampon main body **1004** has a structure that is similar to the tampon main body **1004** shown in FIG. **1**A and includes an absorbent body **1005** and a cord **1008**.

The applicator **1010** includes an outer cylinder **1011** and an inner cylinder **1020**. As shown in FIG. **9**B, the outer cylinder **1011** includes a minor diameter part **1012** and a major diameter part **1013**. In a manner similar to the outer cylinder **1011** shown in FIG. **1**A, the major diameter part **1013** includes a leading-end opening **1014** formed at the leading end and a plurality of petaloid parts **1015** surrounding the leading-end opening. On the other hand, the minor diameter part **1012** does not include an annular protrusion **1017** (FIG. **1**A) formed thereon. The inner cylinder **1020** differs from the inner cylinder **1020** shown in FIG. **1**A (the inner cylinder **1020** having the first inner cylinder **1021** and the second inner cylinder **1025**) and includes a single inner cylinder only.

<<Manufacturing Method and Assembling Apparatus **1040** of Tampon **1001**>>

The tampon **1001** of the above-mentioned structure is also manufactured in accordance with the manufacture flowchart shown in FIGS. **2**A and **2**B. However, since there is only one inner cylinder **1020**, manufacturing is simplified as compared to the first embodiment. Also, when supplying the outer cylinder **1011** at the assembling apparatus **1040**, the outer cylinder **1011** is oriented by the orienting mechanism **1060**. The orienting mechanism **1060** of the second embodiment has a structure different from that of the first embodiment (FIG. **5**). Therefore, in the following description, the structure of the orienting mechanism **1060** will be described.

FIG. **10** is a diagram showing a drop chute **1045** of the second embodiment and the neighboring part thereof. FIG. **11**A is a partial cross-sectional view of the drop chute **1045** viewed in Y-direction in FIG. **10**. FIG. **11**B is a cross-sectional view taken along line X-X in FIG. **10**.

The drop chute **1045** does not include an orienting plate **1061** shown in FIG. **5**. In stead, the first protruded parts **1063** and the second protruded parts **1064** are formed by pins protruding from a frame **1045***a* of the drop chute **1045**. The first protruded parts **1063** and the second protruded parts **1064** are provided at the same level in a vertical direction. In the dropping path of the outer cylinder **1011** in the drop chute **1045**, an opening **1062** corresponding to a plane passing through the first protruded parts **1063** and the second protruded parts **1064** is equivalent to the above-mentioned opening **1062**. In a similar manner to the opening **1062** shown in FIG. **6**, the opening **1062** is divided into a one-end opening **1062***a*, a central opening **1062***b* and an other-end opening **1062***c* (see FIG. **11**B).

As shown in FIG. **11**A, in the path of the drop chute **1045**, a bent part **1084** is formed above the first protruded parts **1063** and the second protruded parts **1064**. The outer cylinder **1011** that has proceeded into the drop chute **1045** (for example, the outer cylinder **1011** that has proceeded at an angle into the drop chute **1045**) passes the bent part **1084** and thereby takes an attitude lying along the horizontal direction. Therefore, the minor diameter part **1012** and the major diameter part **1013** will be inputted into the opening **1062** at substantially the same time.

Two pairs of transport rollers **1081** and **1082** are provided on the transport path **1043** at the upstream side of the drop chute **1045** in the transport direction. The transport rollers **1081** and **1082** are pairs of rollers respectively that transport the outer cylinder **1011** while holding the outer cylinder **1011** between them. The outer cylinders **1011** transported through the transport path **1043** are arranged side-by-side and moves to the transport rollers **1081** and **1082**. Here, the rotational speed of the transport rollers **1082** is greater than the rotational speed of the transport rollers **1081**. Therefore, even if two outer cylinders **1011** that are supplied consecutively happen to join (for example, when the petaloid parts **1015** of the two consecutively supplied outer cylinders **1011** are in meshing engagement), the two outer cylinders **1011** can be separated by the transport rollers **1081** and **1082** and the outer cylinder **1011** can proceed into the drop chute **1045** one-by-one.

The orientation of the outer cylinder **1011** dropping in the drop chute **1045** of the above structure can be oriented in a manner described below.

As shown in FIG. **11**B, when the outer cylinder **1011** is inputted into the opening **1062**, since the external diameter of the major diameter part **1013** is greater than the gap between the first protruded parts **1063**, the major diameter part **1013** comes into contact with the pair of first protruded parts **1063** and thus the major diameter part **1013** cannot pass between the pair of first protruded parts **1063**. On the other hand, since the external diameter of the minor diameter part **1012** is smaller than the gap between the second protruded parts **1064**, the minor diameter part **1012** starts passing between the pair of second protruded parts **1064**. Thereafter, as shown in FIG. **10**, with the major diameter part **1013** being in contact with the first protruded parts **1063**, the minor diameter part **1012** completely passes between the second protruded parts **1064**. Then, the major diameter part **1013** passes through the central opening **1062***b* to discharge the outer cylinder **1011** from the opening **1062** (that is to say, the minor diameter part **1012** is discharged first). In this manner, the outer cylinder **1011** is oriented in such a manner that its major diameter part **1013** is at an upper position and its minor diameter part **1012** is at a lower position.

It is to be noted that even if the outer cylinder **1011** is inputted in such a manner that the major diameter part **1013** comes into contact with the second protruded parts **1064**, because the minor diameter part **1012** is discharged first, the outer cylinder **1011** will be oriented.

In this manner, also in the second embodiment, the outer cylinder **1011** can be supplied to the transport conveyor **1050** properly and rapidly because of the orienting mechanism **1060**.

—Other Embodiments—

In the above-mentioned various embodiments, the manufacturing apparatus and the method of manufacturing the tampon of the present invention have been mainly discussed. However, the above-mentioned embodiments are provided for the purpose of facilitating the understanding of the present invention only and do not give any limitation to the present invention. It goes without saying that any modifications and improvements to the present invention can be made without departing from the spirit of the invention and the present invention includes its equivalents. Further, the above-mentioned configurations, etc., are merely examples to show effectiveness of the present invention and should not be understood as any limitation to the present invention.

In the above-mentioned embodiments, the inner cylinder **1020** of the tampon **1001** shown in FIG. **1**A includes the first inner cylinder **1021** and the second inner cylinder **1025**. However, the inner cylinder **1020** may include the first inner cylinder **1021** only.

Also, in the above-mentioned embodiments, the outer cylinder **1011** is oriented by dropping the outer cylinder **1011** shown in FIG. **9** onto the drop chute **1045** shown in FIG. **10**, however, it is not limited thereto.

For example, the outer cylinder **1011** may be oriented by dropping the outer cylinder **1011** shown in FIG. **3**A onto the drop chute **1045** shown in FIG. **10**.

(Part Two)

First, a method of manufacturing a tampon including a tampon main body, an accommodating cylinder accommodating the tampon main body, the accommodating cylinder having an opening formed at a leading end and a plurality of petaloid parts surrounding the opening, and a pushing member that is movable in the accommodating member and pushes the tampon main body out of the accommodating cylinder through the opening, is provided, the method comprising:

performing a broadening process on the accommodating cylinder, the broadening process broadens the opening by outwardly bending each of the plurality of petaloid parts in the radial direction of the accommodating cylinder;

after performing the broadening process, inserting the pushing member into the accommodating cylinder through the opening; and

after performing the broadening process, inserting the tampon main body into the accommodating cylinder through the opening. With such a method of manufacturing a tampon, the pushing member and the tampon main body can be smoothly inserted into the accommodating cylinder.

In the above method of manufacturing a tampon, the method may include: mounting the accommodating cylinder on a mounting jig that is placed on a transport conveyor and transported by the transport conveyor in the transport direction, and

the broadening process is performed on the accommodating cylinder after mounting the accommodating cylinder on

the mounting jig. With such a method of manufacturing a tampon, the broadening process is performed effectively.

In the above method of manufacturing a tampon, the broadening process may be a process of expanding the opening by inserting a tapered part of a jig provided at a leading-end part of the jig, the tapered part thickening from the leading-end side towards the rear end side, pressing the jig against each of the plurality of petaloid parts and bending the each of the plurality of petaloid parts outwardly in the radial direction. With such a method, the broadening process can be performed easily.

In the above method of manufacturing a tampon, in the performing of the broadening process, the jig is pressed against the each of the petaloid parts in such a manner that the each of the petaloid parts inclines outwardly in the radial direction at an angle of inclination between 1 degree and 45 degrees directly after the jig has been separated from each of the plurality of petaloid parts. With such a method, a disadvantage caused by an excessively large angle of inclination can be avoided.

In the above method of manufacturing a tampon, in mounting the accommodating cylinder onto the mounting jig, the accommodating cylinder is mounted on the mounting jig in such a manner that each of the plurality of petaloid parts is exposed from the leading end of the petaloid part to the rear end of the petaloid part. With such a method, since the jig can be properly pressed against each of the petaloid parts, the opening can be properly expanded.

In the above method of manufacturing a tampon, in the performing of the broadening process, the broadening process is performed a plurality of times on the accommodating cylinder. With such a method, the pushing member and the tampon main body can be inserted into the accommodating cylinder through the opening after securely broadening the opening.

In the above method of manufacturing a tampon, the performing of the broadening process includes:

performing the broadening process a plurality of times on the accommodating cylinder before inserting the pushing member into the accommodating cylinder; and

performing the broadening process again on the accommodating cylinder during a period of after having inserted the pushing member into the accommodating cylinder and until the tampon main body is inserted into the accommodating cylinder. With such a method, upon insertion of each of the pushing member and the tampon main body into the accommodating cylinder, the opening can be more securely broadened.

Further, an apparatus for manufacturing a tampon including a tampon main body, an accommodating cylinder accommodating the tampon main body, the accommodating cylinder having an opening formed at a leading end and a plurality of petaloid parts surrounding the opening, and a pushing member that is movable in the accommodating member and pushes the tampon main body out of the accommodating cylinder through the opening, can be achieved, the apparatus including:

a broadening process mechanism that performs a broadening process on the accommodating cylinder, the broadening process broadens the opening by outwardly bending each of the plurality of petaloid parts in the radial direction of the accommodating cylinder;

a pushing member-inserting mechanism that, after performing the broadening process, inserts the pushing member into the accommodating cylinder through the opening; and

a tampon main body-inserting mechanism that, after performing the broadening process, inserts the tampon main body into the accommodating cylinder through the opening. With such an apparatus for manufacturing a tampon, the pushing member and the tampon main body can be smoothly inserted into the accommodating cylinder.

In the above apparatus of manufacturing a tampon,

the broadening process mechanism may include a jig that performs the broadening process;

the jig may include a tapered part that thickens from the leading end towards the rear end that is provided at the leading-end part of a jig and a projecting part that is provided at the rear-end part and projects outside of the outer edge of the rear end of the tapered part; and

the broadening process mechanism may perform the broadening process that expands the opening by inserting the tapered part of the jig into the accommodating cylinder through the opening, pressing a surface that is located at the leading end of the projected part and that projects outside the outer edge against each of the plurality of petaloid parts and bending the each of the plurality of petaloid parts outwardly in the radial direction. With such a structure, the broadening process can be performed easily.

In the above apparatus of manufacturing a tampon,

the broadening process mechanism may include another jig that has a configuration different from that of the jig;

the other jig including another tapered part broadening from the leading end towards the rear end and provided at the leading-end part;

the leading end of the tapered part provided on the jig being flat;

the leading end of the other tapered part provided on the other jig is more pointed than the leading end of the tapered part provided on the jig; and

the broadening process mechanism performing, on the accommodating cylinder before performing the broadening process,

other broadening process that expands the opening by inserting the other tapered part of the jig into the accommodating cylinder through the opening, pressing an outer peripheral surface against each of the plurality of petaloid parts and bending the each of the plurality of petaloid parts outwardly in the radial direction. With an above apparatus for manufacturing a tampon, by performing the other broadening process, the subsequent broadening process can be properly performed.

—Structure of a Tampon—

Before describing a method of manufacturing and a manufacturing apparatus of a tampon of the present invention, the structure of a tampon **2010** manufactured by the method of manufacturing and the manufacturing apparatus will be described with reference to FIGS. **12** to **17**.

FIGS. **12** and **13** are cross-sectional views showing the components of the tampon **2010**. FIG. **12** shows the tampon **2010** in a state where an inner cylinder **2050** is contracted and FIG. **13** shows the tampon **2010** in a state where the inner cylinder **2050** is extended. FIG. **14** is a diagram showing how a first inner cylinder **2051** and a second inner cylinder **2052** are joined and is an enlarged view of the area labeled "X" in FIG. **13**. FIGS. **15**A and **15**B are external views of an outer cylinder **2040**. FIG. **15**C is a diagram showing the outer cylinder **2040** shown in FIG. **15**A from its leading-end side. FIG. **16** is an external view of the first inner cylinder **2051**. FIG. **17** is an external view of the second inner cylinder **2052**. In the following description, among the two end parts in the longitudinal direction of the tampon **2010**, the side that is inserted in to the vaginal cavity is referred to as a leading-end side and the opposite side is referred to as a rear-end side.

As shown in FIG. **12**, the tampon **2010** of the present embodiment is a sanitary product including a tampon main body **2020** and an applicator **2030**. As shown in the same diagram, the tampon main body **2020** includes a cotton body **2021** and a cord **2022**. The cotton body **2021** is an absorbent body that blocks the vaginal cavity and absorbs menstrual blood etc, and is formed by cutting a cotton strip covered with non-woven fabric on both sides and by shaping into a substantially bullet like shape by heat forming. The cord **2022** extends through the rear-end side of the cotton body **2021** and is then held by a user when the cotton body **2021** inside the vaginal cavity is pulled out of the vaginal cavity. As shown in FIG. **12**, the cord **2022** extends through the applicator **2030** and somewhat extends out of the rear end of the applicator.

The applicator **2030** is an aid device for guiding the tampon main body **2020** (specifically, the cotton body **2021**) into a vaginal cavity. As shown in FIG. **12**, the applicator **2030** includes an outer cylinder **2040** which is an example of an accommodating cylinder that accommodates the tampon main body **2020** and an inner cylinder **2050** which is an example of a pushing member that pushes the tampon main body **2020** out of the outer cylinder **2040**.

The outer cylinder **2040** is a cylindrical body formed by injection molding a thermoplastic resin and has an appropriate flexibility. The outer cylinder **2040** includes a major diameter part **2041** provided on the leading-end part and a minor diameter part **2042** provided at the rear-end part and having an external diameter that is smaller than that of the major diameter part **2041**. The major diameter part **2041** is a part that has a slightly greater internal diameter than the diameter of the tampon main body **2020** and accommodates the tampon making body **2020** therein. The major diameter part **2041** is inserted into the vaginal cavity upon usage of the tampon **2010** with the tampon main body **2020** being accommodated therein. The tampon main body **2020** is accommodated in the major diameter part **2041** with its outer peripheral surface being in contact with the inner peripheral surface of the major diameter part **2041**. The minor diameter part **2042** is a part held by a user when using the tampon **2010**. It is to be noted that it is not necessary to provide the minor diameter part **2042** on the outer cylinder **2040**.

As shown in FIGS. **15**A and **15**B, the outer cylinder **2040** includes an opening formed at its leading end (hereinafter referred to as a leading-end opening **2043**) and a plurality of petaloid parts **2044** (in this embodiment, six petaloid parts) surrounding the leading edge opening **2043**. When shipping the tampon **2010**, each of the plurality of petaloid parts **2044** is inwardly bent in an arc in the radial direction of the outer cylinder **2040** as shown in FIG. **15**A. Therefore, when the outer cylinder **2040** is inserted into the vaginal cavity, the leading-end part of the outer cylinder **2040** is substantially hemispherical as shown in FIGS. **12** and **13** and the leading-end opening **2043** is substantially in a closed state as shown in FIG. **15**C. On the other hand, as for the outer cylinder **2040** shortly after being injection molded, each of the plurality of petaloid parts **2044** is open (i.e., along the central axis of the outer cylinder **2040**, as shown in FIG. **15**B), and the leading-end opening **2043** is in an open state.

Further, as shown in FIG. **15**A, the outer cylinder **2040** includes an opening formed at its rear end (hereinafter, referred to as a rear-end opening **2045**) and an annular rib **2046** provided at a position slightly towards the leading-end side than the rear-end opening **2045**. Further, an annular stepped part **2047** is formed between the major diameter part **2041** and the minor diameter part **2042**.

The inner cylinder **2050** is a cylindrical body inserted into the minor diameter part **2042** of the outer cylinder **2040**. The inner cylinder **2050** is located at a position nearer to the rear end-side than the tampon main body **2020** in the outer cylinder **2040** and moves along the central axis of the outer cylinder **2040** to pushes the tampon main body **2020** from the rear towards the leading-end opening **2043**. Thereby, the tampon main body **2020** pushes each of the plurality of petaloid parts **2044** outwardly in the radial direction of the outer cylinder **2040** (in other words, opens the leading-end opening **2043**) and is pushed out of the outer cylinder **2040**. That is to say, the inner cylinder **2050** is movable in the outer cylinder **2040** and has a push-out function to push the tampon main body **2020** out of the outer cylinder **2040** through the leading-end opening **2043**.

It is to be noted that the inner cylinder **2050** of the present embodiment has an extendable structure to make the over all length of the tampon **2010** compact. In detail, when the inner cylinder **2050** is contracted as shown in FIG. **12**, the length of the inner cylinder **2050** is shorter than the outer cylinder **2040** and becomes a length suitable for carrying the tampon **2010**. On the other hand, when the inner cylinder **2050** extends as shown in FIG. **13**, the length of the inner cylinder **2050** will become a length sufficient to push the tampon main body **2020** out of the outer cylinder **2040**. As has been described above, in order to make the inner cylinder **2050** extendable, in this embodiment, the inner cylinder **2050** has a two-tier structure. In detail, as shown in FIG. **12**, the inner cylinder **2050** of the present embodiment includes a first inner cylinder **2051** and a second inner cylinder **2052** that is slidably inserted into the first inner cylinder **2051**.

The first inner cylinder **2051** is a cylindrical body formed by injection molding plastics. The first inner cylinder **2051** has an external diameter that is slightly smaller than the internal diameter of the minor diameter part **2042**. As shown in FIG. **12**, The first inner cylinder **2051** is slidably inserted in the minor diameter part **2042**. As shown in FIG. **16**, an annular flange part **2051***a* is formed on an outer peripheral surface of the leading-end part of the first inner cylinder **2051**. The flange part **2051***a* has an external diameter that is slightly smaller than the major diameter part **2041** of the outer cylinder **2040** and engages an inner surface of the stepped part **2047**, thereby preventing the inner cylinder **2050** from falling off from the rear-end opening **2045** of the outer cylinder **2040**. When the inner cylinder **2050** pushes the tampon main body **2020** out of the outer cylinder **2040**, the inner cylinder **2050** moves in such a manner that the outer peripheral surface of the flange part **2051***a* is in contact with the inner peripheral surface of the major diameter part **2041**. Further, as shown in FIGS. **12** and **13**, at the rear-end side on an inner peripheral surface of the first inner cylinder **2051**, an annular protrusion **2051***b* extending inwardly in the radial direction of the first inner cylinder **2051** is provided.

The second inner cylinder **2052** is a cylindrical body formed by injection molding a thermoplastic resin. The second inner cylinder **2052** has an external diameter that is slightly smaller than the internal diameter of the first inner cylinder **2051**. The second inner cylinder **2052** is, when the inner cylinder **2050** is in a contracted state, inserted in the first inner cylinder **2051** as shown in FIG. **12** and, when the inner cylinder **2050** is in an extended position, connected to the rear-end part of the first inner cylinder **2051** at the leading-end part of the second inner cylinder **2052** as shown in FIG. **13**. Further, as shown in FIG. **17**, on the outer peripheral surface of the leading-end part of the second inner cylinder **2052**, an arcuate flange part **2052***a* and a protruded part **2052***b* located nearer to the rear-end side than the flange part **2052***a* is formed. As shown in FIG. **14**, the height of the protruded part **2052***b* becomes lower at the rear-end. It is to be noted that the

gap between the flange part **2052***a* and the protruded part **2052***b* of the second inner cylinder **2052** is thicker than the thickness of the annular protrusion **2051***b* of the first inner cylinder **2051**.

When the second inner cylinder **2052** is pulled towards the rear-end part, the annular protrusion **2051***b* of the first inner cylinder **2051** will be located between the flange part **2052***a* of the second inner cylinder **2052** and the protruded part **2052***b*. In such a state, as shown in FIG. **14**, the annular protrusion **2051***b* engages the flange part **2052***a* and the protruded part **2052***b* and thereby the first inner cylinder **2051** and the second inner cylinder **2052** are joined.

Further, as shown in FIGS. **12** and **13**, a flared part **2052***c* is formed at the rear end of the second inner cylinder **2052**. Preferably, the external diameter of the flared part **2052***c* is greater than the internal diameter of the first inner cylinder **2051** and greater than the internal diameter of the minor diameter part **2042** of the outer cylinder **2040**.

—Method of Manufacturing a Tampon **2010**—

<<Outline of a Method of Manufacturing the Tampon **2010**>>

Next, a method of manufacturing the tampon **2010** of the present embodiment will be described with reference to FIG. **18** and FIGS. **19**A to **19**D. FIG. **18** is a flowchart showing how the tampon **2010** is manufactured.

FIGS. **19**A to **19**D are diagrams in a series showing how the tampon **2010** is manufactured.

As shown in FIG. **18**, the method of manufacturing the tampon **2010** includes a step of manufacturing each item constituting the tampon **2010** (S**2001**), a step of supplying the manufactured items to an assembly apparatus **2100** to be described later and to manufacture the tampon **2010** by assembling the tampon **2010** (S**2002**), a step of inspecting the manufactured tampon **2010** (S**2003**) and a step of wrapping the tampon **2010** (S**2004**).

In the main manufacturing step S**2002**, firstly, each of the items constituting the tampon **2010** is supplied to the assembling apparatus **2100**. As shown in FIG. **19**A, at the time supplied to the assembling apparatus **2100**, the outer cylinder **2040** is in a state where the plurality of petaloid part **2044** are each in an open state (in other words, the leading-end opening **2043** is open). Then, as shown in FIG. **19**A, the first inner cylinder **2051** is inserted into the outer cylinder **2040** through the leading-end opening **2043** of the outer cylinder **2040**. The first inner cylinder **2051** inserted in the outer cylinder **2040** will be in a state where its rear-end part protrudes through the rear-end opening **2045** of the outer cylinder **2040** and the flange part **2051***a* engages with the inner wall of the stepped part **2047** of the outer cylinder **2040** (see FIG. **19**B).

Then, as shown in FIG. **19**B, the second inner cylinder **2052** is inserted into the outer cylinder **2040** through the leading-end opening **2043**. The second inner cylinder **2052** inserted into the outer cylinder **2040** will be in a state where its rear-end part protrudes through the opening on the rear-end side of the first inner cylinder **2051** and the flange part **2052***a* engages with the inner peripheral surface of the first inner cylinder **2051** (see FIG. **19**C). It is to be noted that, as shown in FIG. **19**B, at the time the second inner cylinder **2052** is supplied to the assembling apparatus **2100**, a flared part **2052***c* is not yet formed on the second inner cylinder **2052**. After the second inner cylinder **2052** has been inserted into the outer cylinder **2040**, the flared part **2052***c* is formed by heat forming the rear-end part of the second inner cylinder **2052**. When the above-described steps are terminated, the assembly of the applicator **2030** is complete.

Then, as shown in FIG. **19**C, the tampon main body **2020** is inserted into outer cylinder **2040** through the leading-end opening **2043**. Here, as shown in FIG. **19**C, the tampon main body **2020** is inserted from its cord **2022** side. When the tampon main body **2020** is inserted in the outer cylinder **2040**, the cotton body **2021** is accommodated in the major diameter part **2041** of the outer cylinder **2040** and the cord **2022** extends out of the rear end of the applicator **2030** (specifically, out of the opening on the rear-end of the second inner cylinder **2052**.) When insertion of the tampon main body **2020** is terminated, the assembly of the tampon **2010** is complete.

After assembling the tampon **2010**, as shown in FIG. **19**D, a process of heat forming is performed in which the leading-end part of the outer cylinder **2040** is formed into a substantially hemispherical shape by bending each of the plurality of petaloid parts **2044** in such a manner that it is inclined inwardly in the radial direction of the outer cylinder **2040** (hereinafter referred to as a leading-end processing). When the leading-end processing is terminated, the main manufacturing step S**2002** is complete.

It is to be noted that, as described below, the assembling apparatus **2100** includes a transport conveyor **2110** (see FIG. **20**). This transport conveyor **2110** intermittently carries out motions of transporting the assembled products in the transport direction (transport motions). Between the transport motions, i.e., when the assembled item is in a rest, each of the above-mentioned steps is sequentially performed.

<<Assembling Step of the Tampon **2010**>>

Next, regarding the above-mentioned main manufacturing step S**2002**, a step of assembling the tampon **2010** will be described in detail with reference to FIG. **20**. FIG. **20** is a diagram showing the assembling apparatus **2100** of the tampon **2010**.

<Assembling Apparatus **2100** of Tampon **2010**>

The step of assembling the tampon **2010** is performed by the assembling apparatus **2100** shown in FIG. **20**. This assembling apparatus **2100** is an example of an apparatus for manufacturing the tampon **2010**. As shown in FIG. **20**, the assembling apparatus **2100** includes a transport conveyor **2110**, an outer cylinder supplying mechanism **2120**, an inner cylinder inserting mechanism **2130** as an example of the pushing-member inserting mechanism, a tampon main body inserting mechanism **2140** and a broadening mechanism **2150**. Hereinafter, each device constituting the assembling apparatus **2100** will be described.

(1) Transport Conveyor **2110**

The transport conveyor **2110** is a device that transports the outer cylinder **2040** and items inserted in the outer cylinder **2040** (first inner cylinder **2051**, second inner cylinder **2052** and tampon main body **2020**) in the transport direction (direction shown by an arrow in FIG. **20**). A mount **2160** that mounts the outer cylinder **2040** thereon is placed on the transport conveyor **2110** and the mount **2160** is transported in the transport direction by the transport conveyor **2110**. Thereby, the outer cylinder **2040** mounted on the mount **2160** and the items inserted in the outer cylinder **2040** are transported in the transport direction together with the mount **2160**.

The mount **2160** is an example of a mounting jig and, as shown in FIG. **20**, the outer cylinder **2040** is mounted thereon with the central axis of the outer cylinder **2040** lying along the vertical direction and the leading-end opening **2043** being facing substantially directly upwards. Circular holes (not shown) are formed in the mount **2160** in the vertical direction. The outer cylinder **2040** is mounted on the mount **2160** by being fitted into the circular hole from the minor diameter part **2042** side.

In this embodiment, as shown in FIG. **21**, in a state where the outer cylinder **2040** is mounted on the mount **2160**, sub-

stantially half of the leading-end side of the outer cylinder **2040** is exposed. Therefore, in the state where the outer cylinder **2040** is mounted on the mount **2160**, each of the plurality of the petaloid parts **2044** is exposed from the leading end of the petaloid part **2044** to the rear end of the petaloid part **2044**. FIG. **21** is a diagram showing the outer cylinder **2040** that is mounted on the mount **2160**.

(2) Outer Cylinder Supplying Mechanism **2120**

The outer cylinder supplying mechanism **2120** is a mechanism that supplies the outer cylinder **2040** to the transport conveyor **2110**. As shown in FIG. **20**, the outer cylinder supplying mechanism **2120** includes an outer cylinder transport feeder **2121**, a supplying path **2122** connected to the end of the transport path included in the outer cylinder transport feeder **2121**, and an outer cylinder setting part (not shown) that sets the outer cylinder **2040** that has passed through the supplying path **2122** to the mount **2160**.

The outer cylinder transport feeder **2121** is a parts feeder having a bowl-shaped vibratory table **2121***a* and transports the outer cylinder **2040** by vibrating the vibratory table **2121***a*. In detail, the vibratory table **2121***a* forms a spiral transport path. By vibrating the vibratory table **2121***a*, the outer cylinder transport feeder **2121** moves the outer cylinders **2040** accumulated at the base of the vibratory table **2121***a* sequentially from the base and along the transport path. The outer cylinder **2040** that has reached the end of the transport path is passed to the supplying path **2122** and travels on the supplying path **2122**.

As shown in FIG. **20**, at the middle part and the end part of the supplying path **2122**, accumulating parts **2122***a* and **2122***c* that temporarily accumulate the outer cylinders **2040** are provided. A drop chute **2122***b* is formed between the accumulating parts **2122***a* and **2122***c*. The outer cylinders **2040** accumulated in the accumulating part **2122***a* provided at the middle part of the supplying path **2122** sequentially drop in the drop chute **2122***b*. It is to be noted that in the drop chute **2122***b*, a restriction mechanism (not shown) that restricts the orientation of the outer cylinder **2040** into a predetermined orientation is provided. While passing through the drop chute **2122***b*, the outer cylinder **2040** is subjected to the action of the restriction mechanism and its orientation is restricted in such a manner that its leading-end comes out of the drop chute **2122***b* first.

Then, the outer cylinders **2040** that came out of the drop chute **2122***b* are accumulated in the accumulating part **2122***c* provided at the end part of the supplying path **2122** in such a manner that the outer cylinders **2040** are oriented in the same orientation. The accumulating part **2122***c* provided at the end of the supplying path **2122** is inclined with a downward slope. The outer cylinder **2040** that has slid down the accumulating part **2122***c* and reached the end of the supplying path **2122** is captured at the above-mentioned outer cylinder setting part. Then, the outer cylinder setting part mounts the caught outer cylinder **2040** onto the mount **2160** placed on the transport conveyor **2110**.

(3) Inner Cylinder Inserting Mechanism **2130**

The inner cylinder inserting mechanism **2130** is a mechanism that inserts the inner cylinder **2050** into the outer cylinder **2040**. In the present embodiment, after the broadening mechanism **2150** has performed the broadening process which is to be described later, the inner cylinder inserting mechanism **2130** inserts the inner cylinder **2050** through the leading-end opening **2043** of the outer cylinder **2040** into the outer cylinder **2040** that is mounted on the mount **2160**. Further, the inner cylinder inserting mechanism **2130** each includes a mechanism that inserts the first inner cylinder **2051** constituting the inner cylinder **2050** into the outer cylinder **2040** (hereinafter referred to as the first inner cylinder inserting mechanism **2131**) and a mechanism that inserts the second inner cylinder **2052** also constituting the inner cylinder **2050** into the outer cylinder **2040** (hereinafter referred to as the second inner cylinder inserting mechanism **2132**).

As shown in FIG. **20**, the first inner cylinder inserting mechanism **2131** includes an inner cylinder transport feeder **2133**, an inner cylinder inserting part **2135** that inserts the first inner cylinder **2051** into the outer cylinder **2040** and a supplying tube **2134** provided between the inner cylinder transport feeder **2133** and the inner cylinder inserting part **2135**.

The inner cylinder transport feeder **2133** is a parts feeder having a structure substantially similar to the outer cylinder transport feeder **2121** and moves the first inner cylinders **2051** sequentially from the base of the bowl-shaped vibratory table **2133***a* and along the spiral transport path formed by the vibratory table **2133***a*. In the present embodiment, as shown in FIG. **20**, the terminal end part of the transport path is constructed by a pair of rails **2133***b*. The pair of rails **2133***b* is a part of the vibratory table **2133***a*.

Between the pair of rails **2133***b*, a gap that is slightly longer than the external diameter of the first inner cylinder **2051** is formed. The first inner cylinder **2051** is held between the pair of rails **2133***b* and travels along the rails **2133***b*. During this, the flange part **2051***a* of the first inner cylinder **2051** hangs at the top part of the rails **2133***b* and the first inner cylinder **2051** is suspended from the rails **2133***b*. That is to say, when the first inner cylinder **2051** travels along the rails **2133***b*, the leading-end of the first inner cylinder **2051** is situated above the rear end. Then, after passing the leading end of the rails **2133***b*, the first inner cylinder **2051** drops with its leading-end being located above the rear-end and is supplied to the inner cylinder inserting part **2135** through the supplying tube **2134**.

The inner cylinder inserting part **2135** receives the first inner cylinder **2051** that has dropped through the supplying tube **2134** and, when the outer cylinder **2040** is at a position below the inner cylinder inserting part **2135**, presses down the first inner cylinder **2051** it has received and inserts the first inner cylinder **2051** into the outer cylinder **2040**. In detail, as shown in FIG. **20**, the inner cylinder inserting part **2135** includes a pressing member **2135***a* that is movable in the vertical direction. By moving the pressing member **2135***a* downwards when situated above the first inner cylinder **2051**, the first inner cylinder **2051** is pressed downwards. The inner cylinder inserting part **2135** inserts the first inner cylinder **2051** into the outer cylinder **2040** through the leading-end with the leading-end of the first inner cylinder **2051** being situated above the rear-end.

Detailed description of the structure of the second inner cylinder inserting mechanism **2132** will be omitted since the second inner cylinder inserting mechanism **2132** has a structure substantially similar to that of the first inner cylinder inserting mechanism **2131**. As shown in FIG. **20**, the inner cylinder inserting part **2135** provided in the second inner cylinder inserting mechanism **2132** to insert the second inner cylinder **2052** into the outer cylinder **2040** is provided downstream in the transport direction of the transport conveyor **2110** of the inner cylinder inserting part **2135** provided in the first inner cylinder inserting mechanism. **2131**. That is to say, after the first inner cylinder inserting mechanism **2131** has inserted the first inner cylinder **2051** into the outer cylinder **2040**, the second inner cylinder inserting mechanism **2132** inserts the second inner cylinder **2052** into the outer cylinder **2040**.

(4) Tampon Main Body Inserting Mechanism **2140**

The tampon main body inserting mechanism **2140** is a mechanism that inserts the tampon main body **2020** into the

outer cylinder **2040** in which the first inner cylinder **2051** and the second inner cylinder **2052** have been inserted (in other words, the assembled applicator **2030**). It is to be noted that, after the broadening mechanism **2150** has performed the broadening process described below, the tampon main body inserting mechanism **2140** of the present embodiment inserts the tampon main body **2020** through the leading-end opening **2043** into the outer cylinder **2040** mounted on the mount **2160**.

As shown in FIG. **20**, the tampon main body inserting mechanism **2140** includes a guide tube **2141**, a suction device **2142** and a pressing member **2143**. As shown in FIG. **20**, the guide tube **2141** is a cylindrical body that covers the leading-end part of the outer cylinder **2040**. The guide tube **2141** is movable in the vertical direction with its central axis lying along the vertical direction. Further, the guide tube **2141** holds the tampon main body **2020** in its inner space. It is to be noted that the tampon main body **2020** is inserted into the guide tube **2141** by an inserting mechanism (not shown) and, as shown in FIG. **20**, held within the guide tube **2141** with the cord **2022** being situated below the cotton body **2021**.

The suction device **2142** takes the air in from the rear-end side of the outer cylinder **2040** (specifically, from an opening at the rear-end side of the second inner cylinder **2052** inserted in the outer cylinder **2040**) when the guide tube **2141** covers the leading-end of the outer cylinder **2040**. The pressing member **2143** is situated directly above the upper-end opening of the guide tube **2141** and is held in a vertically movable manner. When the lower-end part of the guide tube **2141** covers the leading-end part of the outer cylinder **2040**, the pressing member **2143** is inserted into the guide tube **2141** through the upper-end opening of the guide tube **2141**. Thus, the pressing member **2143** presses down the tampon main body **2020** held in the guide tube **2141** and inserts the tampon main body **2020** into the outer cylinder **2040** through the leading-end opening **2043** of the outer cylinder **2040**.

When the outer cylinder **2040** is situated at a position where the leading-end opening **2043** opposes the lower-end opening of the guide tube **2141**, the tampon main body inserting mechanism **2140** of the above-mentioned structure moves the guide tube **2141** downwards. Thus the lower-end part of the guide tube **2141** covers the leading-end of the outer cylinder **2040**. The tampon main body inserting mechanism **2140** presses down the tampon main body **2020** held in the guide tube **2141** by the pressing member **2143**. As a result, the tampon main body **2020** is pushed out from the guide tube **2141** and is inserted into the outer cylinder **2040** through the leading-end opening **2043** of the outer cylinder **2040**.

It is to be noted that the tampon main body inserting mechanism **2140** operates the suction device **2142** when pushing the tampon main body **2020** out of the guide tube **2141**. Accordingly, when the tampon main body **2020** is inserted into the outer cylinder **2040**, the cord **2022** of the tampon main body **2020** is pulled downwards. As a result, the cord **2022** extends through the outer cylinder **2040** and is pulled out of the opening at the rear-end side of the second inner cylinder **2052** inserted in the outer cylinder **2040** (in other words, pulled out from the rear-end of the assembled applicator **2030**).

(5) Broadening Mechanism **2150**

A broadening process is performed as a pre-process before inserting the inner cylinder **2050** and tampon main body **2020** into the outer cylinder **2040** and the broadening mechanism **2150** is a mechanism that performs the broadening process on the outer cylinder **2040**. The broadening process is a process that broadens the leading-end opening **2043** by bending each of the plurality of petaloid parts **2044** surrounding the leading-end opening **2043** of the outer cylinder **2040** outwardly in the radial direction. In this embodiment, as shown in FIG. **20**, the broadening mechanism **2150** includes a first pusher unit **2151**, a second pusher unit **2152** and a third pusher unit **2153**.

The first pusher unit **2151** performs the broadening process on the outer cylinder **2040** before the first inner cylinder **2051** is inserted into the outer cylinder **2040**. The first inner cylinder **2051** is located on the upstream side than the first inner cylinder inserting mechanism **2131** in the transport direction of the transport conveyor **2110**. As shown in FIG. **22**A, the first pusher unit **2151** includes a plurality of pushers **2200** and **2210** (in this embodiment, four pushers), an attachment plate **2220** on which the plurality of pushers **2200** and **2210** are mounted and a driving mechanism (not shown) that reciprocates the attachment plate **2220** in the vertical direction. FIG. **22**A is a diagram showing the first pusher unit **2151**.

The pushers **2200** and **2210** are an example of a jig for the first pusher unit **2151** to perform the broadening process on the outer cylinder **2040** and, in the present embodiment, made of metal. As shown in FIG. **22**A, the plurality of pushers **2200** and **2210** are provided in a line in the transport direction.

When the outer cylinder **2040** comes into a position directly below one of the pushers **2200** and **2210** of the plurality of pushers **2200** and **2210**, the first pusher unit **2151** moves the plurality of pushers **2200** and **2210** downwardly together with the attachment plate **2220** by the driving mechanism. Thus, the leading-end parts of the pushers **2200** and **2210** are inserted into the outer cylinder **2040** through the leading-end opening **2043** of the outer cylinder **2040** and the pushers **2200** and **2210** are pushed against each of the inner surfaces of the plurality of petaloid parts **2044**. As a result, each of the plurality of petaloid parts **2044** is bent outwards in the radial direction of the outer cylinder **2040** by the pushers **2200** and **2210** and thus the leading-end opening **2043** is expanded.

As has been described above, the broadening process of the present embodiment is a process that inserts the leading-end parts of the pushers **2200** and **2210** into the outer cylinders **2040** through the leading-end opening **2043**, presses the pushers **2200** and **2210** against each of the plurality of petaloid parts **2044** and mechanically expands the leading-end openings **2043** by outwardly bending each of the petaloid parts **2044** by the pressure force that is applied to each of the petaloid parts **2044**.

The configuration of the pushers **2200** and **2210** will be described with reference to FIGS. **23** and **24**. FIGS. **23** and **24** are external views of each of the pushers **2200** and **2210**.

The plurality of pushers **2200** and **2210** has substantially the same shape. In detail, as shown in FIGS. **23** and **24**, each of the plurality of pushers **2200** and **2210** is substantially funnel-shaped. Further in detail, each of the pushers **2200** and **2210** includes a tapered part **2201**, **2211** that is provided at the leading-end part and that gradually thickens from the leading-end part towards the read-end part and a projected part **2202**, **2212** that is provided at the rear-end and protrudes outside the outer edge of the rear-end of the tapered part **2201**, **2211**.

The tapered part **2201**, **2211** is a part that has substantially a shape of a frustum of a cone. As shown in FIGS. **23** and **24**, the leading-end part of the tapered part **2201**, **2211** is a circular flat surface. The diameter of the leading-end of the tapered part **2201**, **2211** is shorter than the external diameter of the outer cylinder **2040** (specifically, the external diameter of the major diameter part **2041**). In the present embodiment, the diameter of the leading-end of the tapered part **2201** provided on the most upstream side pusher **2200** is approximately 5 mm and the diameter of the leading-end of the tapered part **2211** provided on the remaining pushers **2100** is

approximately 7 mm. It is to be noted that the external diameter of the outer cylinder **2040** of the present embodiment is approximately 13.5 mm (see FIG. **25**A).

The diameter of the rear end of the tapered part **2201**, **2211** is greater than the external diameter of the outer cylinder **2040** (specifically, greater than the external diameter of the major diameter part **2041**). In the present embodiment, the diameter of the rear end of the tapered part **2201** provided on the most upstream side pusher **2200** is approximately 18 mm and the diameter of the rear end of the tapered part **2211** provided on the remaining pushers **2100** is approximately 20 mm.

As for the tapered part **2201** provided on the most upstream side pusher **2200**, a length from its leading-end to its rear end (in this embodiment, approximately 13 mm) is longer than a length from the leading-end to the rear end of the open petaloid part **2044** (in this embodiment, approximately 8.5 mm). It is to be noted that in this embodiment, a length from the leading-end to the rear end of the tapered part **2211** provided on the remaining pushers **2210** is approximately 8 mm.

Outer peripheral surfaces **2201***a* and **2211***a* of the tapered parts **2201** and **2202** are, as shown in FIGS. **23** and **24**, curved surfaces that curves concavely and inwardly. In other words, a line of intersection between the outer peripheral surfaces **2201***a* and **2211***a* of the tapered parts **2211** and **2211** and a virtual plane lying through the central axis of the tapered parts **2211** and **2211** is an inwardly curved surface (see FIG. **22**A). In the present embodiment, a radius of curvature R of the outer peripheral surface **2201***a* of the tapered part **2201** provided on the most upstream pusher **2200** is approximately 10 mm and the radius of curvature R of the outer peripheral surface **2211***a* of the tapered part **2211** provided on the remaining pushers **2210** is approximately 6.5 mm.

The projected parts **2202** and **2212** are disk-like parts. The projected parts **2202** and **2212** include projected surfaces **2202***a*, **2212***a* that are located at the leading-end of the projected parts **2202** and **2212** and project outside than the outer edge of the rear end of the tapered parts **2201** and **2211**. The diameters of the projected parts **2202** and **2212** are greater than the external diameter of the outer cylinder **2040**. In the present embodiment, the diameter of the projected part **2202** provided on the most upstream pusher **2200** is approximately 30 mm and the diameter of the projected parts **2212** of the remaining pushers **2210** are approximately 36 mm. It is to be noted that other dimensions are as shown in FIGS. **23** and **24**.

Further, in the present embodiment, a part of the outer surface of each pusher **2200** and **2100** pressed against the inner wall surface of the petaloid part **2044** is subject to a surface finishing process so as to prevent damages on the inner wall surface. In detail, the surface finishing process is performed in such a manner that the center line average roughness Ra of the part pressed against the inner surface of the petaloid part **2044** is within a predetermined numerical range (preferably, Ra=3.2 to 6.3 and a maximum of Ra=12.5 to 25).

Using the pushers **2200** and **2210** described above, the first pusher unit **2151** is capable of performing the above-mentioned broadening process in a simple manner. Now, referring to FIGS. **25**A to **25**D, the broadening process by the first pusher unit **2151** will be described. FIGS. **25**A to **25**D are diagrams showing the broadening process. It is to be noted that FIGS. **25**A to **25**D illustrates a case in which the broadening process is performed using the most upstream pusher **2200** among the plurality of pushers **2200** and **2210**.

As shown in FIG. **25**A, when the outer cylinder **2040** comes to a position directly below one of the pushers **2200** and **2210** of the plurality of pushers **2200** and **2210**, the first pusher unit **2151** moves the plurality of pushers **2200** and **2210** downwardly. At this time, the outer cylinder **2040** is in a state where its leading-end opening **2043** is facing substantially upwards. Thereby, the tapered parts **2201** and **2211** provided on the pushers **2200** and **2210** are inserted into the outer cylinder **2040** through the leading-end opening **2043**. Then, the outer peripheral surfaces **2201***a* and **2211***a* of the tapered parts **2201** and **2211** come into contact with each of the inner wall surfaces of the plurality of petaloid parts **44**. As a result, as shown in FIG. **25**B, each of the petaloid parts **2044** bends in such a manner that it inclines outwardly in the radial direction of the outer cylinder **2040** along the outer surfaces **2201***a* and **2211***a* of the tapered parts **2201** and **2211**.

As has been described above, the outer peripheral surfaces **2201***a* and **2211***a* of the tapered parts **2201** and **2211** are curved surfaces. Therefore, when the outer peripheral surfaces **2201***a* and **2211***a* of the tapered parts **2201** and **2211** come into contact with the inner wall surface of each of the plurality of petaloid parts **2044**, each petaloid part will smoothly bend along the outer peripheral surfaces **2201***a* and **2211***a* of the tapered parts **2201** and **2211**.

When the tapered parts **2201** and **2211** are further inserted into the outer cylinder **2040**, as shown in FIG. **25**C, the projected surfaces **2202***a* and **2212***a* of the projected parts **2202** and **2212** provided on the pushers **2200** and **2210** come into contact with the inner wall surface of each of the plurality of petaloid parts **2044**. Thus, each of the plurality of the petaloid parts **2044** will bend until it bends substantially at right angles outwardly in the radial direction. At this time, as shown in FIG. **25**C, the first pusher unit **2151** pushes down the projected surfaces **2202***a* and **2212***a* in such a manner that the projected surfaces **2202***a* and **2212***a* are at a position of about 5 mm downwards from the leading-end position of the outer cylinder **2040** before the broadening process (leading-end position of the petaloid part **2044**).

Thereafter, as shown in FIG. **25**D, the first pusher unit **2151** pulls out the pushers **2200** and **2210** from the outer cylinder **2040** by moving the pushers **2200** and **2210** upwardly. (In other words, separates the pushers **2200** and **2210** from each of the plurality of petaloid parts **2044**.)

According to the above-described procedure, when the first pusher unit **2151** performs the broadening process to the outer cylinder **2040**, the leading-end opening **2043** will be broadened as compared to the time before the broadening process. That is to say, in the present embodiment, the broadening process is performed that expands the leading-end opening **2043** by inserting the pushers **2200** and **2210** into the outer cylinder **2040** through the leading-end opening **2043**, pressing the projected surfaces **2202***a* and **2212***a* of the projected parts **2202** and **2212** of the pushers **2200** and **2210** to each of the plurality of the petaloid parts **2044**, and bending each of the petaloid outwardly in the radial direction of the outer cylinder **2040**.

After the above-mentioned broadening process, the outer cylinder **2040** is kept in a bent shape (specifically, the rear end of each of the petaloid parts **2044** is kept in a bent shape). In detail, as shown in FIG. **25**D, after the broadening process, each of the plurality of petaloid parts **2044** are in an outwardly bent state in the radial direction of the outer cylinder **2040**. It is to be noted that the angle of inclination of the petaloid part **2044** (angle θ in FIG. **25**D) may be greater than or equal to one degree.

It is to be noted that if the petaloid part **2044** inclines outwardly in the radial direction with an angle of 45 degrees or more, it will be disadvantageous for the leading-end process that processes the leading-end part of the outer cylinder **2040** into a substantially hemispherical form. Further, if the petaloid part **2044** is bent too much, it might damage the outer

cylinder **2040**. Therefore, in the present embodiment, the above-mentioned bent shape is formed in such a manner that each of the plurality of the petaloid parts **2044** is inclined at an angle of inclination between one degree and 45 degrees outwardly in the radial direction. In other words, according to the broadening process of the present embodiment, directly after separating the pushers **2200** and **2210** from each of the plurality of petaloid parts **2044**, the pushers **2200** and **2210** are pressed against the each petaloid part **2044** in such a manner that the each petaloid part **2044** is inclined at an angle of inclination between one degree and 45 degrees outwardly in the radial direction.

In the present embodiment, the first pusher unit **2151** performs the broadening process on the outer cylinder **2040** that is mounted on the mount **2160**. As has been described above, the outer cylinder **2040** mounted on the mount **2160** is in a state where each of the plurality of the petaloid part **2044** is exposed from the leading-end of the petaloid part **2044** to the rear end of the petaloid part **2044**. Therefore, it facilitates the pressing of the pushers **2200** and **2210** against the inner wall surface of each of the petaloid parts **2044** and the bending of the each petaloid part **2044** outwardly in the radial direction. Further, since the pushers **2200** and **2210** are pressed against the inner wall surface of each of the plurality of the petaloid parts **2044** with the outer cylinder **2040** being mounted on the mount **2160**, a pressure force exerted on each petaloid part **2044** is substantially even between the petaloid parts **2044**.

The first pusher unit **2151** includes the plurality of pusher units **2200** and **2210** and performs the broadening process on the outer cylinder **2040**, every time the outer cylinder **2040** is positioned directly below each of the pushers **2200** and **2210**. That is to say, in this embodiment, the broadening process is performed a plurality of times (in this embodiment, four times) on the outer cylinder **2040** before inserting the first inner cylinder **2051** into the outer cylinder **2040**. Thus, with the leading-end opening **2043** being securely expanded, every item such as the first inner cylinder **2051** can be inserted into the outer cylinder **2040** through the leading-end opening **2043**.

Further, the first pusher unit **2151** of the present embodiment includes, in addition to the plurality of pushers **2200** and **2210**, other pushers (hereinafter, referred to as an auxiliary pusher **2230**) having a shape different from the plurality of the pushers **2200** and **2210**. Before performing the broadening process using each of the plurality of pushers **2200** and **2210**, the first pusher unit **2151** performs an auxiliary process on the outer cylinder **2040** using the auxiliary pusher **2230**. The auxiliary process is a process broadens the leading-end opening **2043** of the outer cylinder **2040** by inserting the auxiliary pusher **2230** into the outer cylinder **2040** through the leading-end opening **2043** of the outer cylinder **2040**, pressing the auxiliary pusher **2230** against the inner wall surface of each of the plurality of the petaloid parts **2044** and bending outwardly in the radial direction each of the plurality of petaloid parts **2044**. The auxiliary process corresponds to the other broadening process. Hereinafter, the auxiliary pusher **2230** will be described.

The auxiliary pusher **2230** is an example of the other jig and is made of a resin material such as plastics. Similarly to the plurality of pushers **2200** and **2210**, the auxiliary pusher **2230** is attached to the attachment plate **2220**. As shown in FIG. **22**A, the auxiliary pusher **2230** is placed at a position upstream of the most upstream pusher **2200** in the transport direction. Further, as shown in FIG. **26**, the auxiliary pusher **2230** includes other tapered part **2231** at the leading-end side of the auxiliary pusher **2230** that thickens from the leading-end towards the rear end. FIG. **26** is an external view of the auxiliary pusher **2230**.

The other tapered part **2231** is a part that has substantially conical and has a leading-end that is more pointed than the leading-end of the tapered parts **2201** and **2211** provided on the pushers **2200** and **2210**. As shown in FIG. **26**, in the present embodiment, the length between the leading-end to the rear end of the other tapered part **2231** is approximately 12 mm and the diameter of the rear end of the other tapered part **2231** is approximately 16 mm.

When the outer cylinder **2040** comes to a position directly below the auxiliary pusher **2230**, the first pusher unit **2151** having the auxiliary pusher **2230** of the above configuration moves the auxiliary pusher **2230** downwards. Thus, the other tapered part **2231** that is provided on the auxiliary pusher **2230** is inserted into the outer cylinder **2040** through the leading-end opening **2043** of the outer cylinder **2040**. When the other tapered part **2231** is inserted into the outer cylinder **2040**, an outer peripheral surface **2231***a* of the other tapered part **2231** comes into contact with the inner wall surface of each of the plurality of petaloid parts **2044**. Thus, each of the plurality of the petaloid parts **2044** bends along the outer peripheral surface **2231***a* of the other tapered part **2231** in the radial direction of the outer cylinder **2040** and thus the leading-end opening **2043** is expanded.

As has been described above, the auxiliary process is a process that inserts the other tapered part **2231** provided on the auxiliary pusher **2230** into the outer cylinders **2040** through the leading-end opening **2043**, presses the outer peripheral surface **2231***a* of the other tapered part **2231** against each of the plurality of petaloid parts **2044** and expands the leading-end openings **2043** by outwardly bending each of the petaloid parts **2044** in the radial direction. The first pusher unit **2151** performs the above-mentioned auxiliary process on the outer cylinder **2040** before performing the broadening process. The reason for performing the auxiliary process before the broadening process will be described below.

As has been described above, the leading-ends of the tapered parts **2201** and **2211** provided on the pushers **2200** and **2210** of the present embodiment are flat surfaces. On the other hand, there are some cases where the outer cylinder **2040** has petaloid parts **2044** that are slightly inclining inwards at a step before performing the broadening process. If the tapered parts **2201** and **2211** of the pushers **2200** and **2210** are inserted into the outer cylinder **2040** whose petaloid parts **2044** are inclined inwards, the leading-ends of the tapered parts **2201** and **2211** might get caught at the petaloid parts **2044**. As a result, the petaloid parts **2044** will be rolled inward and it becomes difficult to insert the inner cylinder **2050** and the tampon main body **2020** into the outer cylinder **2040**. That is to say, when the broadening process of the present embodiment is performed on the outer cylinder **2040** whose petaloid parts **2044** are inclined inwards, it will be even more difficult to insert each item into the outer cylinder **2040**.

In contrast, the leading-end of the other tapered part **2231** of the auxiliary pusher **2230** is more pointed than the leading-end of the tapered parts **2201** and **2211** of the pushers **2200** and **2210**. Therefore, even if the auxiliary pusher **2230** is inserted into the outer cylinder **2040** whose petaloid parts **2044** are inclined inwards, the leading-end of the auxiliary pusher **2230** will not catch the petaloid parts **2044** inward and roll the petaloid part **2044** inwards.

When the other tapered part **2231** of the auxiliary pusher **2230** is inserted into the outer cylinder **2040** and the outer peripheral surface **2231***a* of the other tapered part **2231** is

pressed against the inner wall surface of the petaloid parts **2044** inclined inwards, the petaloid parts **2044** will open by bending outwards in the radial direction of the outer cylinder **2040**. That is to say, by performing the auxiliary process prior to the broadening process, it will be possible to keep the petaloid parts **2044** open in such a manner that the leading-ends of the tapered parts **2201** and **2211** of the pushers **2200** and **2210** do not catch the petaloid parts **2044** while performing the broadening process. As a result, the first pusher unit **2151** can properly perform the broadening process later on the outer cylinder **2040**.

The second pusher unit **2152** performs a broadening process on the outer cylinder **2040** from the time at which the first inner cylinder **2051** is inserted into the outer cylinder **2040** until the time at which the second inner cylinder **2052** is inserted into the outer cylinder **2040**. The second pusher unit **2152** is located between the first inner cylinder inserting mechanism **2131** and the second inner cylinder inserting mechanism **2132** in the transport direction. The third pusher unit **2153** performs a broadening process on the outer cylinder **2040** from the time at which the second inner cylinder **2052** is inserted into the outer cylinder **2040** until the time at which the tampon main body **2020** is inserted into the outer cylinder **2040**. The third pusher unit **2153** is located between the second inner cylinder inserting mechanism **2132** and the tampon main body inserting mechanism **2140** in the transport direction.

As shown in FIG. **22**B, the second pusher unit **2152** and the third pusher unit **2153** are of substantially similar structure as the first pusher unit **2151** except that the number of pushers **2210** provided is different. FIG. **22**B is a diagram showing the second pusher unit **2152**. It is to be noted that the third pusher unit **2153** is not indicated in the drawings since it has the same structure as the second pusher unit **2152**.

As shown in FIG. **22**B, each unit of the second pusher unit **2152** and the third pusher unit **2153** includes a pusher **2210** which is an example of the jig that performs the broadening process. This pusher **2210** is the same as the pusher **2210** that is located on the downstream side of the most upstream pusher **2200**, among the plurality of pushers **2200** and **2210** provided on the first pusher unit **2151**. That is to say, the broadening process can also be performed using a simple method on the second pusher unit **2152** and the third pusher unit **2153**.

The second pusher unit **2152** and the third pusher unit **2153** perform the broadening process with the substantially similar procedure as the broadening process performed by the first pusher unit **2151**. The second pusher unit **2152** performs the broadening process once on the outer cylinder **2040** from the time at which the first inner cylinder **2051** is inserted into the outer cylinder **2040** until the time at which the second inner cylinder **2052** is inserted into the outer cylinder **2040**. The third pusher unit **2153** performs the broadening process once on the outer cylinder **2040** from the time at which the second inner cylinder **2052** is inserted into the outer cylinder **2040** until the time at which the tampon main body **2020** is inserted into the outer cylinder **2040**.

It is to be noted that the second pusher unit **2152** and the third pusher unit **2153** do not perform the above-mentioned auxiliary process before performing the broadening process. (In other words, it does not include the auxiliary pusher **2230**.) This is because, at the step of performing the broadening process, each of the second pusher unit **2152** and the third pusher unit **2153** are at least inclined outwards in the radial direction and therefore it is not necessary to perform the auxiliary process again.

As has been described above, the broadening mechanism **2150** of the present embodiment performs the broadening process on the outer cylinder **2040** each time at a step before inserting each of the first pusher unit **2151**, the second pusher unit **2152** and the tampon main body **2020** into the outer cylinder **2040**. However, it is not limited to this and it is sufficient if the broadening process is performed at least from the time at which the outer cylinder **2040** is mounted on the mount **2160** until the time at which the inner cylinder **2050** (in this embodiment, the first inner cylinder **2051**) is inserted into the outer cylinder **2040**.

It is to be noted that in this embodiment, the broadening mechanism **2150** performs the broadening process on the outer cylinder **2040** in a state where the temperature of the pushers **2200** and **2210** is maintained at a temperature that is 50° C. below the melting point of the thermoplastic resin forming the outer cylinder **2040**. That is to say, the leading-end opening **2043** is not pushed and expanded by heating and softening the outer cylinder **2040** as in the case of heat forming but the leading-end opening **2043** is pushed and expanded only with the pressure force applied by the pushers **2200** and **2210**. Therefore, in the present embodiment, each of the petaloid parts **2044** will not be deformed by heat as in the case of heat forming. The temperature of the pusher **2210** may be within a range between the glass transition point of the thermoplastic resin and the temperature that is 50° C. below the melting point of the thermoplastic resin forming the outer cylinder **2040** and is preferably room temperature.

<Assembling Procedure of Tampon **2010**>

Next, the assembling procedure of the tampon **2010** by the assembling apparatus **2100** will be described with reference to FIG. **27**. FIG. **27** is a flowchart showing the assembling of the tampon **2010**.

As shown in FIG. **27**, the assembling of the tampon **2010** starts with a step of mounting, by the outer cylinder supplying mechanism **2120**, the outer cylinder **2040** on the mount **2160** placed on the transport conveyor **2110** (S**2011**). The transport conveyor **2110** intermittently carries out motions of transporting the mount **2160** each time with a predetermined distance. On the other hand, the outer cylinder supplying mechanism **2120** is synchronized with the transport conveyor **2110** and mounts the outer cylinder **2040** on the mount **2160** between the transport motions (while the mount **2160** is at rest). In the present embodiment, as has been described above, the outer cylinder **2040** is mounted on the mount **2160** in such a manner that each of the plurality of the petaloid parts **2044** is exposed from the leading-end of the petaloid part **2044** to the rear end of the petaloid part **2044**.

Thereafter, by repeating the transport motions intermittently, the outer cylinder **2040** mounted on the mount **2160** is transported together with the mount **2160** to the downstream side in the transport direction. Then, at the time when the outer cylinder **2040** is located directly below the auxiliary pusher **2230** in the transport direction, the auxiliary process is performed on the outer cylinder **2040** mounted on the mount **2160** by the broadening mechanism **2150** (specifically, the first pusher unit **2151**) (S**2012**). The broadening mechanism **2150** is synchronized with the transport conveyor **2110** and performs the auxiliary process on the outer cylinder **2040** while the outer cylinder **2040** is at rest at a position directly below the auxiliary pusher **2230**.

After performing the auxiliary process, when the transport operation is performed once, the outer cylinder **2040** will be positioned directly under the most upstream side pusher **2200**, which is among the plurality of pushers **2200** and **2210** provided at the most upstream side. When the outer cylinder **2040** is at rest at such a position, the broadening mechanism

2150 (specifically, the first pusher unit 2151) performs the broadening process on the outer cylinder 2040 (the outer cylinder 2040 mounted on the mount 2160) (S2013).

In the present embodiment, as has been described above, in the broadening process, the projected surface 2202*a* of the projected part 2202 of the most upstream-side pushers 2200 is pressed against the inner wall surface of each of the plurality of the petaloid parts 2044. As a result, each of the plurality of the petaloid parts 2044 will be bent substantially at right angles outwardly in the radial direction of the outer cylinder 2040. At the time when the most upstream-side pusher 2200 is pulled out of the outer cylinder 2040 (separate from each of the plurality of petaloid parts 2044), the first broadening process terminates. Directly after the first broadening process, the outer cylinder 2040 is kept bent and each of the plurality of petaloid parts 2044 is in a state where it is inclined outwardly in the radial direction at an angle of inclination between 1 degree and 45 degrees.

After the first broadening process, when the transport operation is performed once, the outer cylinder 2040 comes to a position directly under the pusher 2210 that is adjacent to the most upstream-side pusher 2200 (in other words, the second pusher 2210). At this position, when the outer cylinder 2040 is at rest, a second broadening process is performed on the outer cylinder 2040. Thereafter, the transport operation and the broadening process are repeated in turns and four broadening processes are performed. As the number of implementation of the broadening process increases, the angle of inclination of the petaloid part 2044 directly after the broadening process will gradually increase. It is to be noted that, directly after the fourth broadening process, the angle of inclination of the petaloid part 2044 is between 1 degree and 45 degrees.

After having performed the broadening process on the outer cylinder 2040 for a plurality of times, the transport motion is repeated and the outer cylinder 2040 on which the broadening process is performed is transported towards the downstream side in the transport direction with the mount 2160. Then, when the outer cylinder 2040 is located at a position below the first inner cylinder inserting mechanism 2131, the first inner cylinder 2051 is inserted into the outer cylinder 2040 through the leading-end opening 2043 by the first inner cylinder inserting mechanism 2131 (S2014). That is to say, in the present embodiment, after transporting the outer cylinder 2040 subjected to the broadening process is transported together with the mount 2160 by the transport conveyor 2110 to the downstream side in the transport direction, the first inner cylinder 2051 is inserted into the outer cylinder 2040. The first inner cylinder inserting mechanism 2131 synchronizes with the transport conveyor 2110 and the first inner cylinder inserting mechanism 2131 inserts the first inner cylinder 2051 into the outer cylinder 2040 while the outer cylinder 2040 is at rest below the first inner cylinder inserting mechanism 2131.

After inserting the first inner cylinder 2051 into the outer cylinder 2040, the transport motion is repeated. Then, while the outer cylinder 2040 is located directly below the pusher 2210 of the second pusher unit 2152 and the outer cylinder 2040 is at rest at that position, the broadening process is performed again on the outer cylinder 2040 (S2015). It is to be noted that, directly after the broadening process, the angle of inclination of the petaloid part 2044 is in a range from 1 degree to 45 degrees.

Thereafter, the transport motion is repeated and the second inner cylinder 2052 is inserted into the outer cylinder 2040 through the leading-end opening 2043 by the second inner cylinder inserting mechanism 2132, while the outer cylinder 2040 is located at a position below the second inner cylinder inserting mechanism 2132 and is at rest at such a position (S2016). That is to say, the outer cylinder 2040 on which the broadening process was performed again after insertion of the first inner cylinder 2051 is transported together with the mount 2160 to the downstream side in the transport direction by the transport conveyor 2110 and then the second inner cylinder 2052 is inserted into the outer cylinder 2040.

After inserting the second inner cylinder 2052 into the outer cylinder 2040, the transport motion is repeated. Then, at the time when the outer cylinder 2040 (the first inner cylinder 2051 and the second inner cylinder 2052) has reached in the transport direction at a position where a heat forming part (not shown) is provided, heat forming is performed that forms the flared part 2052*c* at the rear-end part of the second inner cylinder 2052 (S2017). When the heat forming is terminated, the assembling of the applicator 2030 is complete.

After performing the heat forming, the transport motion is further repeated. Then, while the outer cylinder 2040 (in other words, the assembled applicator 2030) is located at the position directly below the pusher 2210 of the third pusher unit 2153 and the outer cylinder 2040 is at rest at such a position, the broadening process is performed on the outer cylinder 2040 once more (S2018). It is to be noted that, directly after the broadening process, the angle of inclination of the petaloid part 2044 is in a range between 1 degree and 45 degrees.

Then, the transport operation is repeated and, when the outer cylinder 2040 (in other words, the assembled applicator 2030) is located at a position below the tampon main body inserting mechanism 2140, the tampon main body 2020 is inserted into the outer cylinder 2040 through the leading-end opening 2043 by the tampon main body inserting mechanism 2140 (S2019). That is to say, the outer cylinder 2040 subjected to the broadening process again after insertion of the inner cylinder 2050 (the first inner cylinder 2051 and the second inner cylinder 2052) is transported together with the mount 2160 to the downstream side in the transport direction by the transport conveyor 2110, and then the tampon main body 2020 is inserted into the outer cylinder 2040. It is to be noted that the tampon main body inserting mechanism 2140 is also synchronized with the transport conveyor 2110 and, while the outer cylinder 2040 is at rest with the leading-end opening 2043 opposing the rear-end opening of the guide tube 2141, inserts the tampon main body 2020 held in the guide tube 2141 into the outer cylinder 2040 through the leading-end opening 2043.

According the above-described series of steps, the assembling of the tampon 2010 is completed. The assembled tampon 2010 is transported together with the mount 2160, while being mounted on the mount, towards the step of processing the leading-end of the outer cylinder 2040 into a substantially hemispherical shape.

As has been described above, the manufacturing method of the tampon 2010 of the present embodiment includes mounting the outer cylinder 2040 on the mount 2160 (S2011), broadening the outer cylinder 2040 (S2013, S2015 and S2018), inserting the inner cylinder 2050 into the outer cylinder 2040 through the leading-end opening 2043 after performing the broadening process (S2014 and S2016), and inserting the tampon main body 2020 into the outer cylinder 2040 through the leading-end opening 2043 after performing the broadening process (S2019). Further, the broadening includes performing broadening process a plurality of times to the outer cylinder 2040 before inserting the first inner cylinder 2051 to the outer cylinder 2040 (S2013), performing a broadening process again to the outer cylinder 2040 during the time between insertion of the first inner cylinder 2051 into

the outer cylinder **2040** and insertion of the inner cylinder **2050** into the outer cylinder **2040** (S**2015**) and performing a broadening process again on the outer cylinder **2040** during the time between insertion of the second inner cylinder **2052** into the outer cylinder **2040** and the insertion of the tampon main body **2020** into the outer cylinder **2040** (S**2018**).

—Effectiveness of Manufacturing Method of the Tampon **2010** of the Present Embodiment—

According to the manufacturing method of a tampon of the present embodiment, a broadening process is performed on the outer cylinder **2040** in which each of the plurality of the petaloid parts **2044** surrounding the leading-end opening **2043** of the outer cylinder **2040** is bent outwardly in the radial direction of the outer cylinder **2040** to broaden the leading-end opening **2043**. Then, after performing the broadening process, the inner cylinder **2050** (specifically, the first inner cylinder **2051** and the second inner cylinder **2052**) and the tampon main body **2020** are inserted into the outer cylinder **2040** through the leading-end opening **2043**. Thus, the inner cylinder **2050** and the tampon main body **2020** can be smoothly inserted into the outer cylinder **2040**. Hereinafter, the effectiveness of the manufacturing method of the tampon **2010** of the present embodiment will be described in detail.

When manufacturing the tampon **2010** of the present embodiment, since each of the outer cylinder **2040**, the inner cylinder **2050** and the tampon main body **2020** has the above-mentioned shape, the inner cylinder **2050** and the tampon main body **2020** will be inserted into the outer cylinder **2040** through the leading-end opening **2043**. That is to say, the leading-end opening **2043** serves as an insert inlet when inserting the inner cylinder **2050** and the tampon main body **2020** into the outer cylinder **2040**. As has been described above in the "Problem To Be Solved By The Invention," in order to improve the production speed of the tampon **2010**, it is necessary to insert the inner cylinder **2050** and the tampon **2010** into the outer cylinder **2040** through the leading-end opening **2043** smoothly.

Now, there are cases where the petaloid parts **2044** incline inwardly in the radial direction during the period from injection molding of the outer cylinder **2040** to the mounting on the mount **2160**, due to a collision between outer cylinder **2040**, etc. When the petaloid parts **2044** incline inwardly in the radial direction, the leading-end opening **2043** becomes smaller and therefore it will be difficult to insert the inner cylinder **2050** and the tampon main body **2020** into the outer cylinder **2040** through the leading-end opening **2043**. Also, if the inner cylinder **2050** and the tampon main body **2020** are forced to be inserted into the outer cylinder **2040** under such a condition, the petaloid parts **2044** will be rolled into the outer cylinder **2040** and thus a defective tampon **2010** will be manufactured.

Particularly, like the tampon **2010** of the present embodiment, in cases where the difference between the external diameter of the inner cylinder **2050** and the internal diameter (specifically, the difference between the external diameter of the flange part **2051***a* of the tampon main body **2020** and the internal diameter of the major diameter part **2041**) and the difference between the diameter of the tampon main body **2020** and the inner diameter of the outer cylinder **2040** are both very small, it becomes even more difficult to insert the inner cylinder **2050** and the tampon main body **2020** into the outer cylinder **2040** through the leading-end opening **2043** in a state where the leading-end opening **2043** has become small.

Therefore, in order to prepare for a case where the petaloid parts **2044** have inclined inwards, it is necessary to have some measures to facilitate the insertion of the inner cylinder **2050** and the tampon main body **2020** into the outer cylinder **2040**. Such measures may be, for example, making the external diameter of the inner cylinder **2050** and the diameter of the tampon main body smaller with respect to the inner diameter of the outer cylinder **2040**. With such a measure, insertion of the inner cylinder **2050** and the tampon main body **2020** into the tampon main body **2020** can be facilitated. However, the outer cylinder **2040** and the inner cylinder **2050** (or the outer cylinder **2040** and the tampon main body **2020**) will not fit well and may cause a problem when using the tampon **2010**.

On the other hand, in the present embodiment, the above-mentioned broadening process is performed on the outer cylinder **2040** before inserting the inner cylinder **2050** and tampon main body **2020** into the outer cylinder **2040**. Thus, the inner cylinder **2050** and the tampon main body **2020** can be inserted into the outer cylinder **2040** through the leading-end opening **2043** with the leading-end opening **2043** being broadened. As a result, the inner cylinder **2050** and the tampon main body **2020** can be smoothly inserted into the outer cylinder **2040** without changing the external diameter of the inner cylinder **2050** or the diameter of the tampon main body **2020**. Also, since each of the plurality of petaloid parts **2044** are bent outwardly in the radial direction of the outer cylinder **2040**, the above-mentioned problem, that is to say, the rolling-in of the petaloid part **2044** into the outer cylinder **2040**, can be prevented. Thereby, the tampon **2010** can be assembled properly.

As has been described above, by performing the broadening process on the outer cylinder **2040** before inserting the inner cylinder **2050** and the tampon main body **2020** into the outer cylinder **2040**, the inner cylinder **2050** and the tampon main body **2020** can be smoothly inserted into the outer cylinder **2040** and the tampon **2010** can be assembled properly. Therefore, according to the manufacturing method of the tampon **2010** of the present embodiment, the production speed of the tampon **2010** can be improved.

Further, in the present embodiment, the broadening process is performed on the outer cylinder **2040** after mounting the outer cylinder **2040** on the mount **2160**. That is to say, the broadening is a process in which broadening is performed on the outer cylinder **2040** after mounting the outer cylinder **2040** onto the mounting cylinder. This is because it is highly possible that the petaloid parts **2044** incline inwardly during the period from the injection molding of the outer cylinder **2040** to its mounting on the mount **2160** (specifically, during a period from the mounting onto the vibratory table **2121** of the outer cylinder transport feeder **2121** to the supplying to the transport conveyor **2110**). Therefore, if the broadening process is performed on the outer cylinder **2040** after mounting the outer cylinder **2040** on the mount **2160**, the broadening process will be performed effectively. The outer cylinder **2040** subjected to the broadening process is transported by the transport conveyor **2110** to the downstream side in the transport direction together with the mount **2160** and then the inner cylinder **2050** (the first inner cylinder **2051** and the second inner cylinder **2052**) is inserted into the outer cylinder **2040**. Thereafter, the outer cylinder **2040** in which the inner cylinder **2050** is inserted is transported by the transport conveyor **2110** to the downstream side in the transport direction together with the mount **2160** and then the tampon main body **2020** is inserted into the outer cylinder **2040**. Thus, it becomes easier to keep the leading-end opening **2043** in an open state until the inner cylinder **2050** and the tampon main body **2020** are inserted into the outer cylinder **2040**.

The present embodiment has been described with reference to an example in which the outer cylinder **2040** is kept mounted on the same mount **2160** during the period from the

mounting of the outer cylinder **2040** onto the mount **2160** to the completion of the assembly of the tampon **2010** (see FIG. **20**), however, it is not limited to such an example. For example, with a structure in which a single outer cylinder **2040** is transported by a plurality of transport conveyors **2110**, when the single outer cylinder **2040** is passed from one transport conveyors **2110** to the other transport conveyor **2110**, the mount **2160** on which the outer cylinder **2040** is mounted is switched over. That is to say, there may be a case where the outer cylinder **2040** mounted on the mount **2160** should be mounted again on another mount **2160**. Even in such a case, by performing the broadening process on the outer cylinder **2040** after the outer cylinder **2040** is mounted on the mount **2160** on which the outer cylinder **2040** is mounted at first (in other words, the mount **2160** that receives the mount **2160** from the outer cylinder supplying mechanism **2120**), the broadening process can be performed efficiently.

Also, in the present embodiment, prior to inserting each of the second inner cylinder **2052** and the tampon main body **2020** into the outer cylinder **2040**, the broadening process is performed each time on the outer cylinder **2040** (S**2013**, S**2015** and S**2018** in FIG. **27**). Thereby, when inserting each of the first inner cylinder **2051**, the second inner cylinder **2052** and the tampon main body **2020** into the outer cylinder **2040**, the leading-end opening **2043** can be broadened more securely.

—Other Embodiments—

The foregoing embodiments are merely for the purpose of elucidating the manufacturing method and manufacturing apparatus (assembling apparatus) of the tampon **2010** of the present invention and are not to be interpreted as limiting the invention. The invention can of course be altered and improved without departing from the gist thereof and equivalents are intended to be embraced therein. Also, the above-mentioned setting values, sizes and configurations, etc., are merely an example provided to show the effect of the present invention and is not to be interpreted as limiting the invention.

In the above-mentioned embodiment, the tampon **2010** having the inner cylinder **2050** of a two-tier structure as a pushing member has been described, but the present invention is not limited thereto. For example, it can be a tampon **2010** having the inner cylinder **2050** with a fixed length (which does not extend or contract).

Also, in the above-mentioned embodiment, the outer cylinder **2040** is mounted on the mount **2160** with the leading-end opening **2043** facing substantially directly upwards. That is to say, the above-mentioned embodiment has a structure that inserts the inner cylinder **2050** (the first inner cylinder **2051** and the second inner cylinder **2052**) and the tampon main body **2020** into the outer cylinder **2040** from above. However, it is not limited to such structure and can be a structure, for example, in which the outer cylinder **2040** is placed on the transport conveyor **2110** in a state where the leading-end opening **2043** is facing substantially directly laterally and the inner cylinder **2050** and the tampon main body **2020** can be inserted into the outer cylinder **2040** from the side. With such a structure, in order to perform the broadening process on the outer cylinder **2040**, the pushers **2200** and **2210** can be inserted into the outer cylinder **2040** from the side and pressed against each of the plurality of the petaloid part **2044** from the side.

Also, in the above-mentioned embodiment, although the inner cylinder **2050** and the tampon main body **2020** are separately inserted into the outer cylinder **2040**, it is not limited to such a structure. For example, it may be a structure in which the tampon main body **2020** is accommodated in the outer cylinder **2040** in a state it is inserted in the inner cylinder **2050**. When manufacturing the tampon **2010** of such a structure, after inserting the tampon main body **2020** into the inner cylinder **2050**, the inner cylinder **2050** in which the tampon main body **2020** is inserted may be inserted into the outer cylinder **2040** (That is to say, the tampon main body **2020** and the inner cylinder **2050** may be inserted into the outer cylinder **2040** at the same time).

Also, in the above-mentioned embodiment, a structure in which the broadening process is performed to the outer cylinder **2040** one by one. However, the present invention is not limited to such a structure and may be a structure in which the broadening process is performed on a plurality of outer cylinders **2040** at the same time. For example, as shown in FIG. **28**, if a plurality of pushers **2200** and **2210** having mutually the same configuration are attached to the attachment plate **2220** in a group, the broadening process can be performed simultaneously on the plurality of outer cylinders **2040** (in the structure shown in FIG. **28**, two outer cylinders **2040**). FIG. **28** is a diagram showing the structure for simultaneously performing the broadening process on a plurality of outer cylinders **2040** and is a diagram corresponding to FIG. **22**A.

(Part Three)

An apparatus for manufacturing a tampon, the tampon including an absorbent body that absorbs liquid, an accommodating member that is cylindrical and accommodates the absorbent body, and a pushing member that moves inside the accommodating member and pushes the absorbent body out of the accommodating member, the accommodating member including a minor diameter part provided at a one-end part thereof and a major diameter part provided at an other-end part thereof, the major diameter part having an external diameter greater than that of the minor diameter part, is provided, the apparatus including:

an orienting mechanism that orients the accommodating member;

a first inserting mechanism that inserts the pushing member into the accommodating member oriented by the orienting mechanism; and

a second inserting mechanism that inserts the absorbent body into the accommodating member in which the pushing member is inserted,

the orienting mechanism including:

an opening through which the accommodating member is inputted;

a pair of first protruded parts located on one-end side in a longitudinal direction of the opening and protruding inwardly in an opposing manner into the opening; and

a pair of second protruded parts located on other-end side in the longitudinal direction of the opening and protruding inwardly in an opposing manner into the opening,

a gap between the pair of first protruded parts being greater than the external diameter of the minor diameter part and smaller than the external diameter of the major diameter part, and

a gap between the pair of second protruded parts being greater than the external diameter of the minor diameter part and smaller than the external diameter of the major diameter part.

With such an apparatus of manufacturing a tampon, since the accommodating cylinder received by the receiving part when there is the accommodating cylinder in the receiving part is discharged out of the second transport path, the accommodating cylinders can be prevented from being piled up before the receiving part. Thereby, the accommodating cylinders are prevented from being joined to each other and thus the accommodating cylinder can be supplied properly.

In the above apparatus for manufacturing a tampon,

the supplying mechanism may include:

a parts feeder having a placing table and moves the accommodating cylinder placed on the placing table towards the first transport path; and

a third transport path that transports the accommodating cylinder that is discharged out of the second transport path through the outlet to the placing table. With the above apparatus for manufacturing a tampon, the accommodating cylinder that is discharged out of the second transport can be transported again to the second transport path.

In the above apparatus for manufacturing a tampon,

each of the first transport path and the third transport path is inclined in such a manner that the accommodating cylinder slides down on each of the first transport path and the third transport path;

the receiving part is a recess between the first transport path and the third transport path;

the recess receives the accommodating cylinder which has slid down the first transport path when there is no accommodating cylinder in the recess and receives the accommodating cylinder which has slid down the first transport path when there is the accommodating cylinder in the recess in such a manner that it is piled on top of the accommodating cylinder in the recess; and

the side wall discharges the accommodating cylinder piled on top of the accommodating cylinder in the recess out of the second transport path through the outlet.

With such an apparatus for manufacturing a tampon, the accommodating cylinder can be discharged out of the second transport path by making use of the momentum acquired by the accommodating cylinder sliding down on the first transport path.

In the above apparatus for manufacturing a tampon,

the outlet may be a cutaway part formed in the side wall;

the side wall includes a retaining part provided below the cutaway part, the retaining part retains, in the receiving part, the accommodating cylinder received by the receiving part when there is no accommodating cylinder in the receiving part;

a height of the retaining part being smaller than the external diameter of the one-end part in the longitudinal direction of the accommodating cylinder;

a height of a part of the side wall that is adjacent to the retaining part in the second transport direction being greater than the external diameter of the one-end part in the longitudinal direction of the accommodating cylinder. With an apparatus for manufacturing a tampon of such a structure, the accommodating cylinder that cannot fit on the second transport path can be properly discharged out of the second transport path and the accommodating cylinder that is traveling on the second transport path can be prevented from falling off from the second transport path.

The above apparatus for manufacturing a tampon may further include:

an orienting mechanism that orients the accommodating cylinder;

the first transport path transporting the accommodating cylinder that has been oriented by the orienting mechanism into the first transport direction; and

the orienting mechanism orients the accommodating cylinder in such a manner that the accommodating cylinder travels on the first transport path with the one-end part in the longitudinal direction of the accommodating cylinder being located on an upstream side in the first transport direction than the other-end part in the longitudinal direction of the accommodating cylinder. When the accommodating cylinder is passed from the first transport path to the second transport path, the accommodating cylinder may collide with the side wall. If the one-end part in the longitudinal direction where the petaloid parts are provided collides with the side wall, the petaloid parts may bend inwardly. With the above structure, the petaloid parts can be prevented from bending inwards.

Further, a method of manufacturing a tampon including a tampon main body, an accommodating cylinder that accommodates the tampon main body, and a pushing member that moves in the accommodating cylinder and pushes the tampon main body out of the accommodating cylinder, a plurality of petaloid parts being provided at a one-end part in the longitudinal direction of the accommodating cylinder, may be provided, the method including:

supplying the accommodating cylinder by a supplying mechanism; and

inserting, by an inserting mechanism, the tampon main body and the pushing member into the accommodating cylinder supplied by the supplying mechanism,

the supplying mechanism including:

a first transport path transporting the accommodating cylinder in a first transport direction lying along the longitudinal direction of the accommodating cylinder; and

a second transport path transporting the accommodating cylinder in a second transport direction intersecting the longitudinal direction of the accommodating cylinder,

the second transport path including:

a receiving part that receives from the first transport path the accommodating cylinder that has traveled on the first transport path;

a side wall formed on an end part opposite to a side where the accommodating cylinder is passed to the receiving part from the first transport path in the first transport direction; and

an outlet that is formed in the side wall and discharges the accommodating cylinder out of the second transport path,

the side wall retains in the receiving part the accommodating cylinder which the receiving part has received when there is no accommodating cylinder in the receiving part and discharges out of the second transport path through the outlet the accommodating cylinder which the receiving part has received when there is an accommodating cylinder in the receiving part. As has been described above, with such a method of manufacturing a tampon, the other accommodating cylinder can be prevented from being caught into the one-end part in the longitudinal direction of the accommodating cylinder and thus the accommodating cylinder can be supplied properly.

—Structure of Tampon—

In describing an apparatus and method of manufacturing a tampon of the present invention, the structure of the tampon **3010** manufactured by such apparatus and method of manufacturing will be described with reference to FIGS. **29** through **34**.

FIGS. **29** and **30** are cross-sectional views showing the components of the tampon **3010**. FIG. **29** shows the tampon **3010** in a state where the inner cylinder **3050** is contracted and FIG. **30** shows the tampon **3010** in a state where the inner cylinder **3050** is extended. FIG. **31** is a diagram showing how the first inner cylinder **3051** and the second inner cylinder **3052** are joined and is an enlarged view of the area labeled "X" in FIG. **30**. FIGS. **32**A and **32**B are external views of the outer cylinder **3040**. FIG. **32**C is a diagram showing the outer cylinder **3040** shown in FIG. **32**A from its leading-end side. FIG. **33** is an external view of the first inner cylinder **3051**. FIG. **34** is an external view of the second inner cylinder **3052**. In the following description, in the longitudinal direction of the tampon **3010**, the side which is inserted in to the vaginal

cavity is referred to as a leading-end side and the opposite side is referred to as a rear-end side.

As shown in FIG. **29**, the tampon **3010** of the present embodiment is a sanitary product including a tampon main body **3020** and an applicator **3030**. As shown in the same diagram, the tampon main body **3020** includes a cotton body **3021** and a cord **3022**. The cotton body **3021** is an absorbent body that blocks the vaginal cavity and absorbs liquid such as menstrual blood, and is formed by cutting a cotton strip covered with non-woven fabric on both sides and by shaping into a substantially bullet like shape by heat forming. The cord **3022** extends through the rear-end side of the cotton body **3021** and is then held by a user when the cotton body **3021** inside the vaginal cavity is pulled out of the vaginal cavity. As shown in FIG. **29**, the cord **3022** extends through the applicator **3030** and somewhat extends out of the rear end of the applicator.

The applicator **3030** is an aid device for guiding the tampon main body **3020** (specifically, the cotton body **3021**) into a vaginal cavity. As shown in FIG. **29**, the applicator **3030** includes an outer cylinder **3040** which is an example of a cylindrical accommodating member that accommodates the tampon main body **3020** and an inner cylinder **3050** which is an example of a pushing member that pushes the tampon main body **3020** out of the outer cylinder **3040**.

The outer cylinder **3040** is a cylindrical body formed by injection molding a thermoplastic resin and has an appropriate flexibility. The outer cylinder **3040** includes a major diameter part **3041** provided on the leading-end part (corresponds to a one-end part in the longitudinal direction) and a minor diameter part **3042** provided at the rear-end part (corresponds to an other-end part in the longitudinal direction) and having an external diameter that is smaller than that of the major diameter part **3041**. That is to say, an internal diameter of the leading-end part of the outer cylinder **3040** is greater than an external diameter of the rear-end part. It is to be noted that the dimensions of each part of the outer cylinder **3040** in the present embodiment is as shown in FIG. **32**B.

The major diameter part **3041** is apart that has a slightly greater internal diameter than the diameter of the tampon main body **3020** and accommodates the tampon main body **3020** therein. The major diameter part **3041** is inserted into the vaginal cavity upon usage of the tampon **3010** with the tampon main body **3020** being accommodated therein. The tampon main body **3020** is accommodated in the major diameter part **3041** with its outer peripheral surface being in contact with the inner peripheral surface of the major diameter part **3041**. The minor diameter part **3042** is a part held by a user when using the tampon **3010**.

As shown in FIGS. **32**A and **32**B, the outer cylinder **3040** includes an opening formed at a leading end (hereinafter referred to as a leading-end opening **3043**) of the outer cylinder **3040** and a plurality of petaloid parts **3044** (in this embodiment, six petaloid parts) at the leading-end part of the outer cylinder **3040** and surrounding the leading edge opening **3043**. When shipping the tampon **3010**, each of the plurality of petaloid parts **3044** is inwardly bent in an arc in the radial direction of the outer cylinder **3040** as shown in FIG. **32**A. Therefore, when the outer cylinder **3040** is inserted into the vaginal cavity, the leading-end part of the outer cylinder **3040** is substantially hemispherical as shown in FIGS. **29** and **30** and the leading-end opening **3043** is substantially in a closed state as shown in FIG. **32**C. On the other hand, as for the outer cylinder **3040** shortly after being injection molded, each of the plurality of petaloid parts **3044** is open (i.e., along the central axis of the outer cylinder **3040**, as shown in FIG. **32**B), and the leading-end opening **3043** is in an open state.

Further, as shown in FIG. **32**A, the outer cylinder **3040** includes an opening formed at a rear end of the outer cylinder **3040** (hereinafter, referred to as a rear-end opening **3045**) and an annular rib **3046** provided at a position slightly towards the leading-end side than the rear-end opening **3045**. Further, an annular stepped part **3047** is formed between the major diameter part **3041** and the minor diameter part **3042**.

The inner cylinder **3050** is a cylindrical body inserted into the minor diameter part **3042** of the outer cylinder **3040**. The inner cylinder **3050** is located at a position nearer to the rear end-side than the tampon main body **3020** in the outer cylinder **3040** and moves along the central axis of the outer cylinder **3040** to pushes the tampon main body **3020** from the rear towards the leading-end opening **3043**. Thereby, the tampon main body **3020** pushes each of the plurality of petaloid parts **3044** outwardly in the radial direction of the outer cylinder **3040** (in other words, opens the leading-end opening **3043**) and is pushed out of the outer cylinder **3040**. That is to say, the inner cylinder **3050** is movable in the outer cylinder **3040** and has a push-out function to push the tampon main body **3020** out of the outer cylinder **3040** through the leading-end opening **3043**.

It is to be noted that the inner cylinder **3050** of the present embodiment has an extendable structure to make the over all length of the tampon **3010** compact. In detail, when the inner cylinder **3050** is contracted as shown in FIG. **29**, the length of the inner cylinder **3050** is shorter than the outer cylinder **3040** and becomes a length suitable for carrying the tampon **3010**. On the other hand, when the inner cylinder **3050** extends as shown in FIG. **30**, the length of the inner cylinder **3050** will be a length sufficient to push the tampon main body **3020** out of the outer cylinder **3040**. As has been described above, in order to make the inner cylinder **3050** extendable, in this embodiment, the inner cylinder **3050** has a two-tier structure. In detail, as shown in FIG. **29**, the inner cylinder **3050** of the present embodiment includes a first inner cylinder **3051** and a second inner cylinder **3052** that is slidably inserted into the first inner cylinder **3051**.

The first inner cylinder **3051** is a cylindrical body formed by injection molding plastics. The first inner cylinder **3051** has an external diameter that is slightly smaller than the internal diameter of the minor diameter part **3042**. As shown in FIG. **29**, The first inner cylinder **3051** is slidably inserted in the minor diameter part **3042**. As shown in FIG. **33**, an annular flange part **3051***a* is formed on an outer peripheral surface of the leading-end part of the first inner cylinder **3051**. The flange part **3051***a* has an external diameter that is slightly smaller than the major diameter part **3041** of the outer cylinder **3040** and engages with an inner surface of the stepped part **2047**, thereby preventing the inner cylinder **3050** from falling off from the rear-end opening **2045** of the outer cylinder **3040**. When the inner cylinder **3050** pushes the tampon main body **3020** out of the outer cylinder **3040**, the inner cylinder **3050** moves in such a manner that the outer peripheral surface of the flange part **3051***a* is in contact with the inner peripheral surface of the major diameter part **3041**. Further, as shown in FIGS. **29** and **30**, at the rear-end side on an inner peripheral surface of the first inner cylinder **3051**, an annular protrusion **3051***b* extending inwardly in the radial direction of the first inner cylinder **3051** is provided.

The second inner cylinder **3052** is a cylindrical body formed by injection molding a thermoplastic resin. The second inner cylinder **3052** has an external diameter that is slightly smaller than the internal diameter of the first inner cylinder **3051**. The second inner cylinder **3052** is, when the inner cylinder **3050** is in a contracted state, inserted in the first inner cylinder **3051** as shown in FIG. **29** and, when the inner

cylinder **3050** is in an extended position, connected to the rear-end part of the first inner cylinder **3051** at the leading-end part of the second inner cylinder **3052** as shown in FIG. **30**. Further, as shown in FIG. **34**, on the outer peripheral surface of the leading-end part of the second inner cylinder **3052**, an arcuate flange part **3052***a* and a protruded part **3052***b* located nearer to the rear-end side than the flange part **3052***a* is formed. As shown in FIG. **31**, the height of the protruded part **3052***b* becomes lower at the rear-end. It is to be noted that the gap the gap between the flange part **3052***a* of the second inner cylinder **3052** and the protruded part **3052***b* is thicker than the thickness of the annular protrusion **3051***b* of the first inner cylinder **3051**.

When the second inner cylinder **3052** is pulled towards the rear-end part, the annular protrusion **3051***b* of the first inner cylinder **3051** will be located between the flange part **3052***a* of the second inner cylinder **3052** and the protruded part **3052***b*. In such a state, as shown in FIG. **31**, the annular protrusion **3051***b* engages the flange part **3052***a* and the protruded part **3052***b* and thereby the first inner cylinder **3051** and the second inner cylinder **3052** are joined.

Further, as shown in FIGS. **29** and **30**, a flared part **3052***c* is formed at the rear end of the second inner cylinder **3052**. Preferably, the external diameter of the flared part **3052***c* is greater than the internal diameter of the first inner cylinder **3051** and greater than the internal diameter of the minor diameter part **3042** of the outer cylinder **3040**.

—Method of Manufacturing a Tampon **3010**—

A method of manufacturing the tampon **3010** of the present embodiment will be described with reference to FIGS. **35**A to **35**D. FIGS. **35**A and **35**B are flowcharts showing how a tampon **3010** is manufactured. FIGS. **36**A to **36**D are diagrams in a series showing how a tampon **3010** is manufactured.

As shown in FIG. **35**A, the method of manufacturing the tampon **3010** includes a step of manufacturing each item constituting the tampon **3010** (S**3001**), a step of supplying the manufactured items to an assembly apparatus **3100** to be described later and to manufacture the tampon **3010** by assembling the tampon **3010** (hereinafter referred to as a main manufacturing step S**3002**), a step of inspecting the manufactured tampon **3010** (S**3003**) and a step of wrapping the tampon **3010** (S**3004**).

As shown in FIG. **35**B, the main manufacturing step S**3002** starts with a step of supplying the injection molded outer cylinder **3040** (S**3011**). This step is performed by the supplying mechanism **3120** described later. It is to be noted that the outer cylinder **3040** at the step of being supplied by the supplying mechanism is in a state where the plurality of petaloid part **3044** are each in an open state (in other words, the leading-end opening **3043** is open). Thereafter, a step of inserting the tampon main body **3020** and the inner cylinder **3050** into the outer cylinder **3040** supplied by the supplying mechanism **3120** is performed (S**3012**). This step is performed by the inserting mechanism **3130** to be described later. The tampon **3010** is gradually assembled in accordance with the progress of the step.

Now, the procedure of inserting the tampon main body **3020** and the inner cylinder **3050** into the outer cylinder **3040** is described in detail. As shown in FIG. **36**A, the first inner cylinder **2051** is inserted into the outer cylinder **3040** through the leading-end opening **3043** of the outer cylinder **3040**. The first inner cylinder **3051** inserted into the outer cylinder **3040** will be in a state where its rear-end part protrudes from the rear-end opening **3045** of the outer cylinder **3040** and the flange part **3051***a* engages the inner wall of the stepped part **3047** of the outer cylinder **3040** (see FIG. **36**B).

Then, as shown in FIG. **36**B, the second inner cylinder **3052** is inserted into the outer cylinder **3040** through the leading-end opening **3043**. The second inner cylinder **3052** inserted in the outer cylinder **3040** will be in a state where its rear-end part protrudes through the opening on the rear-end side of the first inner cylinder **3051** and the flange part **3052***a* engages with the inner peripherals surface of the first inner cylinder **3051** (see FIG. **36**C). It is to be noted that, as shown in FIG. **36**B, at the time supplied to the assembling apparatus **3100**, a flared part **3052***c* is not yet formed on the second inner cylinder **3052**. After the second inner cylinder **3052** is inserted into the outer cylinder **3040**, the flared part **3052***c* will be formed by thermoforming the rear-end part of the second inner cylinder **3052**. When the above-described steps are terminated, the assembly of the applicator **3030** is complete.

Then, as shown in FIG. **36**C, the tampon main body **3020** is inserted into outer cylinder **3040** through the leading-end opening **3043**. At this point, as shown in FIG. **36**C, the tampon main body **3020** is inserted from its cord **3022** side. When the tampon main body **3020** is inserted in the outer cylinder **3040**, the cotton body **3021** is accommodated in the major diameter part **3041** of the outer cylinder **3040** and the cord **3022** extends out of the rear end of the applicator **3030** (specifically, out of the opening on the rear-end of the second inner cylinder **3052**). When the insertion of the tampon main body **3020** is terminated, the assembly of the tampon **3010** is complete.

After assembling the tampon **3010** in a manner described above, as shown in FIG. **36**D, a process of heat forming is performed in which the leading-end of the outer cylinder **3040** is formed into a substantially hemispherical shape by bending each of the plurality of petaloid parts **2044** in such a manner that it is inclined inwardly in the radial direction of the outer cylinder **3040** (hereinafter referred to as a leading-end processing). When the leading-end processing is terminated, the main manufacturing step S**3002** is complete.

It is to be noted that as described below, the assembling apparatus **3100** includes an assembling conveyor **3110** (see FIG. **37**). This assembling conveyor **3110** intermittently carries out motions of transporting the assembled product in the transport direction (transport motions). Between the transport motions, i.e., when the assembled item is in a rest, each of the above-mentioned steps is sequentially performed.

—Assembling Apparatus **3100** of Tampon **3010**—

In the above-mentioned main manufacturing step S**3002**, a series of steps of assembling the tampon **3010** is performed by the assembling apparatus **3100** shown in FIG. **37**. FIG. **37** is a diagram showing the assembling apparatus **3100**. This assembling apparatus **3100** is an example of a manufacturing apparatus of the tampon **3010** and as shown in FIG. **37**, includes an assembling conveyor **3110**, a supplying mechanism **3120** and an inserting mechanism **3130**.

The assembling conveyor **3110** is a device that transports the outer cylinder **3040** and items inserted in the outer cylinder **3040** (first inner cylinder **3051**, second inner cylinder **3052** and tampon main body **3020**) in the transport direction (direction indicated by an arrow in FIG. **37**). A mount **3160** that mounts the outer cylinder **3040** thereon is placed on the assembling conveyor **3110** and the mount **3160** is transported in the transport direction by the assembling conveyor **3110**. Thereby, the outer cylinder **3040** mounted on the mount **3160** and the items inserted in the outer cylinder **3040** are transported in the transport direction together with the mount **3160**. Circular holes **3161** (for example, see FIG. **39**) are formed in the mount **3160** in the vertical direction and the outer cylinder **3040** is mounted on the mount **3160** by fitting

into the circular hole **3161** from the rear-end side. The outer cylinder **3040** mounted on the mount **3160** will be in a state that the central axis of the outer cylinder **3040** lies along the vertical direction and the leading-end opening **3043** faces directly upwards as shown in FIG. **37**.

The supplying mechanism **3120** is a mechanism that individually supplies the injection molded outer cylinder **3040**. As shown in FIG. **37**, some of the outer cylinders **3040** supplied by the supplying mechanism **3120** are mounted on the mount **3160** and are transported by the assembling conveyor **3110** together with the mount **3160**. It is to be noted that an orienting mechanism **3170** that orients the outer cylinders **3040** is built in the supplying mechanism **3120** of the present embodiment. (In other words, the assembling apparatus **3100** of the present embodiment includes an orienting mechanism **3170**.) This orienting mechanism **3170** orients the outer cylinders **3040** in such a manner that the orientation of the outer cylinder **3040** supplied by the supplying mechanism **3120** is in the predetermined orientation. Since the outer cylinders **3040** are oriented by the orienting mechanism **3170**, the outer cylinders **3040** are mounted on the mount **3160** in a state shown in FIG. **37**. (That is to say, the central axis of the outer cylinder **3040** lies along the vertical direction and the leading-end opening **3043** faces directly upwards.) Details of each of the supplying mechanism **3120** and the orienting mechanism **3170** will be described later.

The inserting mechanism **3130** is a mechanism that inserts the inner cylinder **3050** and the tampon main body **3020** into the outer cylinder **3040** mounted on the mount **3160** that is apart of the outer cylinders **3040** supplied by the supplying mechanism **3120**. As shown in FIG. **37**, the inserting mechanism **3130** includes an inner cylinder inserting mechanism **3140** that inserts the inner cylinder **3050** into the outer cylinder **3040** and a tampon main body inserting mechanism **3150** that inserts the tampon main body **3020** into the outer cylinder **3040**.

The inner cylinder inserting mechanism **3150** inserts the inner cylinder **3050** into the outer cylinder **3040** mounted on the mount **3160** through the leading-end opening **3043** of the outer cylinder **3040**. It is to be noted that the inner cylinder inserting mechanism **3140** of the present embodiment includes a mechanism that inserts a first inner cylinder **3051** constituting the outer cylinder **3040** into the outer cylinder **3040** (hereinafter referred to as a first inner cylinder inserting mechanism **3141**) and a mechanism that similarly inserts the second inner cylinder **3052** constituting the inner cylinder **3050** into the outer cylinder **3040** (hereinafter referred to as a second inner cylinder inserting mechanism **3142**) respectively.

As shown in FIG. **37**, the first inner cylinder inserting mechanism **3141** includes an inner cylinder feeder **3143**, an inner cylinder pressing device **3145** that presses and inserts the first inner cylinder **3051** into the outer cylinder **3040** and a tube **3144** provided between the inner cylinder feeder **3143** and the inner cylinder pressing device **3145**.

The inner cylinder feeder **3143** is a parts feeder including a bowl-shaped vibratory table **3143***a*. By vibrating the vibratory table **3143***a*, the inner cylinder feeder **3143** moves the first inner cylinders **3051** accumulated at the bottom part of the vibratory table **3143***a* sequentially and spirally from the bottom part.

Also, as shown in FIG. **37**, a pair of rails **3143***b* is connected to the terminal end part of the vibratory table **3143***a*. Between the pair of rails **3143***b*, a gap that is slightly longer than the external diameter of the first inner cylinder **3051** is formed. The first inner cylinder **3051** that has moved on the vibratory table **3143***a* travels along the rails **3143***b* while being held between the pair of rails **3143***b*. At this time, the flange part **3051***a* of the first inner cylinder **3051** hangs at the top part of the rails **3143***b* and the first inner cylinder **3051** will be suspended from the rails **3143***b*. Then, after passing the terminal end of the rails **3143***b*, the first inner cylinder **3051** drops with the leading-end of the first inner cylinder **3051** being located above the rear-end and supplied to the inner cylinder pressing device **3145** through the tube **3144**.

The inner cylinder pressing device **3145** receives the first inner cylinder **3051** that has dropped through the tube **3144**. When the outer cylinder **3040** is transported to a position below the inner cylinder pressing part **3145** by the assembly conveyor **3110**, the inner cylinder pressing device **3145** presses down the received first inner cylinder **3050** by a pressing jig **3145***a*. Thus, the first inner cylinder **3051** is inserted into the outer cylinder **3040** through the leading-end opening **3043** of the outer cylinder **3040**.

Since the second inner cylinder inserting mechanism **3142** has a structure that is substantially similar to that of the first inner cylinder inserting mechanism **3141**, it will not be described in detail here. As shown in FIG. **37**, the second inner cylinder inserting mechanism **3142** is provided at a downstream position, in the transport direction of the transport conveyor **2110**, than the first inner cylinder inserting mechanism **3141**. Accordingly, the second inner cylinder inserting mechanism **3142** inserts the second inner cylinder **3052** into the outer cylinder **3040** in which the first inner cylinder **3051** is inserted.

The tampon main body inserting mechanism **3140** inserts the tampon main body **3020** into the outer cylinder **3040** through the leading-end opening **3043** of the outer cylinder **3040**. The tampon main body inserting mechanism **3150** is provided on the downstream side of the inner cylinder inserting mechanism **3140** in the transport direction of the assembling conveyor **3110**. Accordingly, the tampon main body inserting mechanism **3150** inserts the tampon main body **3020** into the outer cylinder **3040** in which the first inner cylinder **3051** and the second inner cylinder **3052** are inserted (in other words, the assembled applicator **3030**). As shown in FIG. **37**, the tampon main body inserting mechanism **3150** includes a guide tube **3151**, a suction device **3152** and a tampon main body pressing device **3153**.

The guide tube **3151** is a cylindrical body that guides the tampon main body **3020** when the tampon main body **3020** is inserted into the outer cylinder **3040**. With the tampon main body **3020** being held inside the guide tube **3151**, the guide tube **3151** is connected to the outer cylinder **3040** mounted on the mount **3160** as shown in FIG. **37**. In detail, when the outer cylinder **3040** is transported to the position below the guide tube **3151** by the assembling conveyor **3110**, the guide tube **3151** is lowered. Thus, the leading-end part of the outer cylinder **3040** will fit into the lower end of the guide tube **3151**. It is to be noted that the tampon main body **3020** is held inside the guide tube **3151** in such a manner that the cord **3022** hangs down at a position below the cotton body **3021**.

The tampon main body pressing device **3153** presses down the tampon main body **3020** held inside the guide tube **3151** in a state that the guide tube **3151** is connected to the outer cylinder **3040**. Thereby, the tampon main body **3020** moves inside the guide tube **3151** and is inserted into the outer cylinder **3040** connected to the guide tube **3151** from the side where the cord **3022** is provided.

The suction device **3152** takes the air in from the rear-end side of the outer cylinder **3040** (specifically, an opening at the rear-end side of the second inner cylinder **3052** inserted in the outer cylinder **3040**) while the tampon main body pressing device **3153** is pressing the tampon main body **3020**. Accord-

ing to the suction of the suction device **3152**, the cord **3022** will be pulled directly downwards when the tampon main body **3020** is inserted into the outer cylinder **3040**. As a result, the cord **3022** will smoothly passes through the leading-end opening **3043** of the outer cylinder **3040**. It is to be noted that at the time when the tampon main body **3020** is accommodated into the outer cylinder **3040**, the cord **3022** is somewhat pulled out of the rear-end opening (in other words, the rear end of the assembled applicator **3030**) of the second inner cylinder **3052** inserted into the outer cylinder **3040**.

—Structure of Supplying Mechanism **3120** and Orienting Mechanism **3170**—

<Structure of Supplying Mechanism **3120**>

The structure of the above-described supplying mechanism **3120** will be described with reference to FIGS. **38** and **39**. FIG. **38** is an enlarged view of the supplying mechanism **3120** shown in FIG. **37**. FIG. **39** is a top plan view of the supplying mechanism **3120**.

As has been described above, the supplying mechanism **3120** supplies the injection molded outer cylinders **3040** individually. That is to say, the outer cylinder **3040** supplied by the supplying mechanism **3120** is set at regular intervals on the assembling conveyor **3110**. (Specifically, it is mounted on the mount **3160** placed on the assembling conveyor **3110**.) Also, as shown in FIG. **38**, the supplying mechanism **3120** includes an outer cylinder feeder **3121**, a transport path **3122** and an outer cylinder setting part **3123**. Hereinafter, each component of the supplying mechanism **3120** will be described.

<Outer Cylinder Feeder **3121**>

The outer cylinder feeder **3121** is a parts feeder **3121** including a bowl-shaped vibratory table **3121***a* and is a device that moves the outer cylinder **3040** mounted on the vibratory table **3121***a* by vibrating the vibratory table **3121***a*. Here, the vibratory table **3121***a* is an example of the placing table. Then the injection molded outer cylinders **3040** are once accumulated at the bottom part of the vibratory table **3121***a* and then move spirally from the bottom part as shown in FIG. **39**. It is to be noted that the outer cylinder **3040** moves on the vibratory table **3121***a* in such a manner that its direction of movement (in FIG. **39**, the direction shown by a broken-line arrow) lies along the longitudinal direction of the outer cylinder **3040**. Then, the outer cylinder feeder **3121** moves the plurality of outer cylinders **3040** in such a manner that the plurality of outer cylinders **3040** aligns in the direction of movement on the vibratory table **3121***a*.

<Transport Path **3122**>

The transport path **3122** receives the outer cylinder **3040** that has moved on the vibratory table **3121***a* and to transport the outer cylinder **3040**. As shown in FIG. **38**, the transport path **3122** includes, from the top, a guide path **3200**, a drop chute **3210**, a first transport path **3220**, a second transport path **3230** and a third transport path **3240**.

The guide path **3200** is apart of the transport path **3122** that receives the outer cylinder **3040** from the outer cylinder feeder **3121** and guides the outer cylinder **3040** to the drop chute **3210**. The guide path **3200** is formed at the upstream side end part of the transport path **3122** and is located at the upper most position in the transport path **3122**. The starting end part of the guide path **3200** is directly connected to the vibratory table **3121***a* and the terminal end part of the guide path **3200** extends to an opening **3211** in the drop chute **3210**. After being passed to the guide path **3200**, the outer cylinder **3040** that has moved on the vibratory table **3121***a* is guided by the guide path **3200** and moves towards the drop chute **3210**. It is to be noted that since the starting end part of the guide part **3200** is directly connected to the vibratory table **3121***a*, the vibration of the vibratory table **3121***a* is transferred to the guide part **3200**. Therefore, since the guide part **3200** vibrates by the vibration transferred from the vibratory table **3121***a*, the outer cylinder **3040** will move on the guide part **3200**.

Also, as shown in FIGS. **38** and **39**, when the outer cylinder **3040** is passed from the vibratory table **3121***a* to the guide part **3200**, the orientation of the outer cylinder **3040** is changed. In detail, the orientation of the outer cylinder **3040** that has moved on the vibratory table **3121***a* in the longitudinal direction of the outer cylinder **3040** is changed in such a manner that it moves in a direction intersecting the longitudinal direction of the outer cylinder **3040** on the guide path **3200**. The purpose of changing the orientation of the outer cylinder **3040** is to input the outer cylinder **3040** into the drop chute **3210** in such a state that the longitudinal direction of the outer cylinder **3040** lies along the longitudinal direction of the opening **3211** of the drop chute **3210**. The outer cylinder **3040** the orientation of which has turned over in a manner described above travels on the guide path **3200** while maintaining such an orientation. On the other hand, the outer cylinder **3040** whose orientation was not properly changed will be rejected and returns to the bottom part of the vibratory table **3121***a*.

The outer cylinder **3040** that has moved on the guide path **3200** is inputted into the drop chute **3210** one by one. Here, a number of outer cylinders **3040** passed from the outer cylinder feeder **3121** to the guide path **3200** at a unit time is greater than a number of outer cylinders **3040** inputted into the drop chute **3210** from the guide path **3200** at a unit time. Therefore, on the guide path **3200**, as shown in FIGS. **38** and **39**, the outer cylinders **3040** are temporarily accumulated side-by-side (specifically, in a state that they are aligned in a direction intersecting the longitudinal direction of the outer cylinder **3040**).

The drop chute **3210** is a part of the transport path **3122** through which the outer cylinder **3040** that has traveled on the guide path **3200** is dropped substantially directly downwards. The opening **3211** in the drop chute **3210** is substantially rectangular and is adjacent to the terminal end part of the guide path **3200**. Among the outer cylinders **3040** accumulated on the guide path **3200**, the outer cylinder **3040** located at the most terminal part of the guide path **3200** is inputted and dropped into the drop chute **3210** through the opening **3211**. As has been described above, the outer cylinder **3040** is inputted into the drop chute **3210** with the longitudinal direction of the outer cylinder **3040** lying along the longitudinal direction of the opening **3211**.

Further, the orienting mechanism **3170** is provided at the opening **3211** of the drop chute **3210**. While being inputted into the drop chute **3210** from the opening **3211**, the outer cylinder **3040** is oriented by the orienting mechanism **3170**. To be more specifically, the orientation of the outer cylinder **3040** is oriented in such a manner that the rear end part of the outer cylinder **3040** drops before the leading-end part. Thereafter, the outer cylinder **3040** maintains the orientation mentioned above and drops to the lower-end part of the drop chute **3210**.

The first transport path **3220** is a part that is connected to the lower-end part of the drop chute **3210** and transports the outer cylinder **3040** that has dropped through the drop chute **3210**. The outer cylinder **3040** that has been sent from the outer cylinder feeder **3121** reaches the first transport path **3220** via the guide path **3200** and the drop chute **3210** and then transported by the first transport path **3220**. In other words, the outer cylinder feeder **3121** moves the outer cylin-

der **3040** mounted on the vibratory table **3121***a* provided in the outer cylinder feeder **3121** towards the first transport path **3220**.

The first transport path **3220** transports the outer cylinder **3040** in the first transport direction (direction labeled "C1" in FIGS. **38** and **39**) lying along the longitudinal direction of the outer cylinder **3040**. The first transport path **3220** is inclined in such a manner that the outer cylinder **3040** slides down the first transport path **3220**. Further, since the first transport path **3220** is located at a position on the downstream side of the orienting mechanism **3170**, the first transport path **3220** transports the outer cylinder **3040** that has been oriented by the orienting mechanism **3170**. As has been described above, the orienting mechanism **3170** orients the outer cylinder **3040** in such a manner that the rear end part of the outer cylinder **3040** drops before the leading-end part. Therefore, the outer cylinder **3040** will move on the first transport path **3220** with the leading-end part of the outer cylinder **3040** being located on the upstream side the rear-end part.

The second transport path **3230** is a part that is connected to the terminal end part of the first transport path **3220** and receives and transports the outer cylinder **3040** that has traveled on the first transport path **3220** from the first transport path **3220**. The second transport path **3230** is, in a similar manner to the first transport path **3220**, inclined in such a manner that the outer cylinder **3040** slides down the second transport path **3230**. The second transport path **3230** extends towards the assembling conveyor **3110**. Therefore, the outer cylinder **3040** slides down the second transport path **3230** and moves towards the assembling conveyor **3110**. The outer cylinder **3040** that has slid down the second transport path **3230** is passed to an outer cylinder setting part **3123** which will be described later and set on the assembling conveyor **3110** by the outer cylinder setting part **3123**.

As shown in FIGS. **38** and **39**, the second transport path **3230** is formed in such a manner that it intersects with (specifically, so as to be perpendicular to) the first transport path **3220**. Therefore, the second transport direction (direction labeled "C2" in FIG. **39**) in which the second transport path **3230** transports the outer cylinder **3040** intersects (is perpendicular to) the first transport direction. In other words, the second transport path **3230** transports the outer cylinder **3040** received from the first transport path **3220** in the second transport direction that intersects with (is perpendicular to) the longitudinal direction of the outer cylinder **3040**.

In the following description, the purpose of providing the direction in which the second transport path **3230** transports the outer cylinder **3040** (second transport direction) in such a manner that it intersects (is perpendicular to) the direction in which the first transport path **3220** transports the outer cylinder **3040** (first transport direction) will be described.

As shown in FIGS. **38** and **39**, there is a case where the outer cylinders **3040** accumulate in the second transport path **3230**. This is because the number of outer cylinders **3040** passed from the first transport path **3220** to the second transport path **3230** per unit time is greater than the number of outer cylinders **3040** passed from the second transport path **3230** to the outer cylinder setting part **3123** per unit time. Now, assuming a case in which the second transport path **3230** transports the outer cylinders **3040** in the direction lying along the longitudinal direction of the outer cylinder **3040**, from the reason described above, the outer cylinders **3040** will accumulate in the direction lying along the longitudinal direction of the outer cylinder **3040** on the second transport path **3230** (that is to say, the outer cylinders **3040** accumulate in a longitudinally aligned state). Also, by means of the orienting mechanism **3170**, the outer cylinder **3040** is oriented in such a manner that it travels on the first transport path **3220** with the leading-end part of the outer cylinder **3040** being located upstream of the rear-end part in the first transport direction. As a result, if the outer cylinders **3040** accumulate on the second transport path **3230** in a longitudinally aligned manner, the outer cylinders **3040** will be mutually connected on the second transport path **3230**.

Explaining in detail, among the outer cylinders **3040** accumulated on the second transport path **3230**, if we focus on the neighboring two outer cylinders **3040**, the rear-end part of the outer cylinder **3040** at the upstream side is caught in the leading-end opening **3043** of the outer cylinder **3040** at the downstream side (a so-called jamming). This jamming occurs when the plurality of petaloid parts **3044** provided on the downstream side outer cylinder **3040** inclines outwards and the leading-end opening **3043** is broadened, and the rear-end part of the outer cylinder **3040** on the upstream side easily get caught in such rear-end opening **3045**.

Whereas in the present embodiment, the outer cylinders **3040** are accumulated on the second transport path **3230** in a side-by-side manner. Therefore, the jamming does not occur on the second transport path **3230** and the outer cylinders **3040** can be properly accumulated on the second transport path **3230**. As shown in FIGS. **38** and **39**, the outer cylinders **3040** accumulated on the second transport path **3230** are in mutually the same orientation. This is because the outer cylinders **3040** travels on the first transport path **3220** with the same orientation oriented by the orienting mechanism **3170** and passed to the second transport path **3230** while keeping the same orientation.

The starting-end part of the second transport path **3230** (i.e., the upstream end part of the second transport path **3230** in the second transport direction) is connected to the terminal end part of the first transport path **3220** via a stepped part and is located at a position lower than the terminal end part of the first transport path **3220** (for example, see FIG. **42**). Therefore, the outer cylinder **3040** that has slid down the first transport path **3220** drops after reaching the terminal end of the first transport path **3220** and is received by the starting end part of the transport path **3230**. In other words, the starting end part of the second transport path **3230** includes a receiving part **3231** that receives the outer cylinder **3040** that has traveled (slid down) the first transport path **3220** from the first transport path **3220**. As will be described later, the receiving part **3231** of the present embodiment is capable of holding a single outer cylinder **3040** received from the second transport path **3230**.

Further, the second transport path **3230** includes side walls **3232** and **3233** at both end parts in the direction intersecting the second transport direction (the first transport direction). The side walls **3232** and **3233** extends from the upstream side part of to the downstream side part the second transport path **3230** and stands substantially upright. The outer cylinder **3040** on the second transport path **3230** travels on the second transport path **3230** in a state that it is held between the side walls **3232** and **3233**. The gap between the side walls **3232** and **3233** is somewhat longer than the length between the leading-end part and the rear end part of the outer cylinder **3040** while the petaloid parts **3044** are open (specifically, approximately 66 mm) and is approximately 80 mm in the present embodiment. (See FIG. **42**).

As shown in FIG. **38**, among the side walls **3232** and **3233**, in the side wall **3232** formed at the end part (hereinafter referred to as one-end part) at the side where the outer cylinder **3040** is passed from the first transport path **3220** to the receiving part **3231** in the first transport direction, an inlet

3232*a* is formed that guides the outer cylinder **3040** that has traveled on the first transport path **3220** into the receiving part **3231**.

On the other hand, the end part (hereinafter referred to as other-end part) opposite to the side to which the outer cylinder **3040** is passed to the receiving part **3231**, an outlet **3233***a* is formed that discharges the outer cylinder **3040** out of the second transport path **3230**. From this outlet **3233***a*, the outer cylinder **3040** received by the receiving part **3231** while the outer cylinder **3040** is on the receiving part **3231** (that is to say, the outer cylinder **3040** that the receiving part **3231** which is already holding the outer cylinder **3040** has newly received) is discharged. It is to be noted that either of the inlet **3232***a* and outlet **3233***a* is provided at the starting-end part of the second transport path **3230** and is located at substantially the same position in the second transport direction.

The third transport path **3240** is a part connected to the starting-end part of the second transport path **3230** and receives and transports the outer cylinder **3040** discharged out of the second transport path **3230** through the above-mentioned outlet **3233***a*. The third transport path **3240** is, in a similar manner to the first transport path **3220** and the second transport path **3230**, inclined in such a manner that the outer cylinder **3040** slides down the third transport path **3240**. Further, the third transport path **3240** extends from the outlet **3233***a* to the base part of the vibratory table **3121***a* of the outer cylinder feeder **3121**. Therefore, the outer cylinder **3040** that is discharged out of the second transport path **3230** through the outlet **3233***a* is returned to the outer cylinder feeder **3121** by sliding on the third transport path **3240** and will travel again on the transfer path **3122** from the transport path **3122**.

<Outer Cylinder Setting Part **3123**>

The outer cylinder setting part **3123** receives the outer cylinder **3040** that has slid down the second transport path **3230** from the second transport path **3230** and sets the outer cylinder **3040** on the assembling conveyor **3110**. In detail, the outer cylinder setting part **3123** mounts the outer cylinder **3040** received from the second transport path **3230** on the mount **3160** placed on the assembling conveyor **3110**.

As shown in FIGS. **40**A and **40**B, the outer cylinder setting part **3123** includes an outer cylinder receiving table **3123***a* and a rotator mechanism (not shown) that rotates the outer cylinder receiving table **3123***a*. FIGS. **40**A and **40**B are diagrams showing the outer cylinder setting part **3123**. The outer cylinder receiving table **3123***a* is located at a position adjacent to the terminal-end part of the second transport path **3230** in the second transport direction. The outer cylinder receiving table **3123***a* is located below the terminal end of the second transport path **3230**. The outer cylinder receiving table **3123***a* receives the outer cylinder **3040** dropped from the terminal end part of the second transport path **3230**. It is to be noted that the number of outer cylinders that the outer cylinder receiving table **3123***a* can receive is one.

As shown in FIG. **40**A, the outer cylinder receiving table **3123***a* receives the outer cylinder **3040** in a state that its longitudinal direction lying along the horizontal direction. After receiving the outer cylinder **3040**, the outer cylinder receiving table **3123***a* rotates in such a manner that the longitudinal direction of the outer cylinder receiving table **3123***a* inclines against the horizontal direction as shown in FIG. **40**B. Thus, the outer cylinder **3040** on the outer cylinder receiving table **3123***a* will slide down on the outer cylinder receiving table **3123***a*. At this time, the outer cylinder **3040** slides down with the rear-end first (in other words, the outer cylinder receiving table **3123***a* rotates in such a manner that the outer cylinder **3040** slides down with its rear-end first). At the front of the lower-end part of the outer cylinder receiving table **3123***a* in an inclined state, the mount **3160** is in a stand-by state. The outer cylinder **3040** that has slid down the outer cylinder receiving table **3123***a* is fitted into a circular hole **3161** of the mount **3160** and is mounted on the mount **3160**.

<<Structure of Orienting Mechanism **3170**>>

Now, the structure of the orienting mechanism **3170** will be described with reference to FIGS. **41**A to **41**C. FIG. **41**A is a diagram showing the position at which the orienting mechanism **3170** is provided. FIG. **41**B is a plan view of the orienting mechanism **3170**. FIG. **41**C is a diagram showing how the outer cylinder **3040** passes through the hole **3171** in the orienting mechanism **3170**.

As shown in FIG. **41**A, the orienting mechanism **3170** of the present embodiment is a flat plate provided at the opening **3211** of the drop chute **3210** and has substantially the same size as the opening **3211**. As shown in FIG. **41**B, the orienting mechanism **3170** includes a hole **3171** formed through which the outer cylinder **3040** may pass and a pair of first protruded parts **3172** and a pair of second protruded parts **3173** protruding inwardly into the hole **3171**.

The hole **3171** is a rectangular hole **3171** and is formed with a size slightly larger than the contour of the outer cylinder **3040**. The outer cylinder **3040** that has traveled on the guide path **3200** is input into the drop chute **3210** by passing through the hole **3171**. It is to be noted that as shown in FIG. **41**B, the outer cylinder **3040** passes through the hole **3171** in such a manner that the longitudinal direction of the outer cylinder **3040** lies along the longitudinal direction of the hole **3171**.

The pair of first protruded parts **3172** is located at one-end side in the longitudinal direction of the hole **3171** and is formed in such a manner that each of the first protruded parts **3172** opposes each other. The pair of second protruded parts **3173** is located at the other-end side in the longitudinal direction of the hole **3171** and is formed in such a manner that each of the second protruded parts **3173** opposes each other. As shown in FIG. **41**C, the gap between the pair of first protruded parts **3172** and the gap between the pair of second protruded parts **3173** are greater than the external diameter of the minor diameter part **3042** of the outer cylinder **3040** and is smaller than the external diameter of the major diameter part **3041**. The external diameter of the annular rib **3046** of the outer cylinder **3040** is greater than the gap between the pair of first protruded parts **3172** and the gap between the pair of second protruded parts **3173**. Accordingly, a part of the outer cylinder **3040** where the major diameter part **3041** and the annular rib **3046** are formed cannot pass between the pair of first protruded parts **3172** and between the pair of second protruded parts **3173**. Whereas, the minor diameter part **3042** can pass between the pair of first protruded parts **3172** and between the pair of second protruded parts **3173**.

Now, the positional relationship between the outer cylinder **3040** that passes through the hole **3171** and the first protruded part **3172** and the second protruded part **3173** will be described. When the outer cylinder **3040** passes through the hole **3171** in a state shown in FIG. **41**C, the first protruded part **3172** and the second protruded part **3173** are located at positions that do not come into contact with the annular rib **3046** in the longitudinal direction of the hole **3171**. The first protruded part **3172** is located at a position that comes into contact with the major diameter part **3041** (specifically, a part closer to the rear-end side than the petaloid part **3044**). Therefore, the first protruded part **3172** is located at a position where the major diameter part **3041** cannot pass through the pair of first protruded parts **3172**. On the other hand, the

second protruded part **3173** is located at a position where the minor diameter part **3042** passes through the pair of second protruded parts **3173**.

When the outer cylinder **3040** passes through the hole **3171** under such a positional relationship, the major diameter part **3041** cannot pass between the pair of first protruded parts **3172** and the minor diameter part **3042** can pass between the pair of second protruded parts **3173**. Thus, the rear-end part of the outer cylinder **3040** will drop first. Thereafter, the outer cylinder **3040** inclines in such a manner that the rear end is located below the leading end. Thereby, the leading-end part of the outer cylinder **3040** will pass through the central part (between the pair of first protruded parts **3172** and the pair of second protruded parts **3173**) in the longitudinal direction of the hole **3171**. As a result, the rear-end part of the outer cylinder **3040** drops through the drop chute **3210** before the leading-end part. Therefore, the outer cylinder **3040** proceeds from the rear-end part into the first transport path **3220** and travels on the first transport path **3220** with the leading-end part of the outer cylinder **3040** being situated on the upstream side than the rear-end part in the first transport direction.

On the other hand, when the outer cylinder **3040** passes through the hole **3171** with an orientation opposite to the orientation shown in FIG. **41**C (the outer cylinder **3040** shown in FIG. **41**C is inverted), the minor diameter part **3042** passes between the pair of first protruded parts **3172** and the major diameter part **3041** cannot pass between the pair of second protruded parts **3173**. Therefore, in the above-mentioned case, the outer cylinder **3040** drops through the drop chute **3210** with its rear-end part prior to the leading-end part. Thus, the outer cylinder **3040** travels on the first transport path **3220** with the leading-end part being situated on the upstream side of the rear-end part in the first transport direction.

—Structure of Discharging the Outer Cylinder **3040** Out of the Second Transport Path **3230**—

In the present embodiment, as has been described above, the outer cylinders **3040** may accumulate on the second transport path **3230**. That is to say, because the outer cylinders **3040** are filled in from the starting end of the second transport path **3230** to the terminal end thereof, there may be a case where the outer cylinders **3040** cannot be fitted in anymore on the second transport path **3230**. (That is to say, the outer cylinders **3040** may stuff up on the second transport path **3230**). Therefore, the outer cylinders **3040** that are newly received by the receiving part **3231** while the outer cylinders **3040** are accumulated from the starting end to the terminal end of the second transport path, are discharged (expelled) from the second transport path **3230**.

Before explaining the structure of discharging the outer cylinders **3040** out of the second transport path **3230**, the second transport path **3230** will be explained again with reference to FIGS. **42** to **44**B.

FIG. **42** is an enlarged view of the area labeled "Y" in FIG. **38**. FIG. **43** is a diagram showing the positional relationship in the vertical direction between the first transport path **3220**, the second transport path **3230** and the third transport path **3240** and viewing such positional relationship in the direction of arrow A shown in FIG. **42**. FIGS. **44**A and **44**B are diagrams showing the state in which the receiving part **3231** receives the outer cylinder **3040** and viewing such a state in the direction of arrow B shown in FIG. **42**.

The second transport path **3230** includes the above-mentioned receiving part **3231** at its starting-end part. As shown in FIG. **42**, the second transport path **3230** includes a restricting plate **3234** provided at the downstream side of the receiving part **3231** in the second transport direction. This restricting plate **3234** restricts the outer cylinders **3040** on the second transport path **3230** in such a manner that each of the outer cylinder **3040** does not pile up on other outer cylinders **3040**. In detail, the gap between the lower surface of the restricting plate **3234** and the bottom surface of the second transport path **3230** is slightly longer than the external diameter of the leading-end part of the outer cylinder **3040** (specifically, approximately 15 mm). The outer cylinder **3040** received by the receiving part **3231** passes between the lower surface of the restricting plate **3234** and the bottom surface of the second transport path **3230** when traveling on the second transport path **3230**. As a result, when the outer cylinders **3040** accumulate on the second transport path **3230**, each of the outer cylinders **3040** will accumulate without piling up on other outer cylinders **3040**.

A part of the restricting plate **3234** that is situated at the most upstream side in the second transport direction is spaced apart from the starting end of the second transport path **3230** (upstream side in the second transport direction) with a distance slightly greater than the external diameter of the major diameter part **3041** of the outer cylinder **3040**. On the other hand, the receiving part **3231** is located between the starting end of the second transport path **3230** and the restricting plate **3234** in the second transport direction. That is to say, the receiving part **3231** of the present embodiment is a space formed between the starting end of the second transport path **3230** and the restricting plate **3234** in the second transport direction. The receiving part **3231** has a width, in the second transport direction, capable of accommodating a single outer cylinder **3040** (see FIG. **42**). It is to be noted that it is not necessary to provide the restricting plate **3234**.

As shown in FIG. **43**, the receiving part **3231** of the present embodiment is a recess provided between the terminal end part of the first transport path **3220** and the starting-end part of the third transport path **3240**. That is to say, the bottom surface of the starting-end part of the second transport path **3230** is located at a position lower than the bottom surface of each of the terminal end part of the first transport path **3220** and the starting-end part of the third transport path **3240**.

The side wall **3232** at the one-end part of the second transport path **3230** (the end part on the side where the outer cylinder **3040** is passed from the first transport path **3220** to the receiving part **3231** in the first transport direction) includes, as has been described above, an inlet **3232***a* formed thereon. As shown in FIG. **42**, the inlet **3232***a* is a substantially rectangular cutaway part (hereinafter, also referred to as a one-end cutaway part) formed on the upstream side end part of the side wall **3232** in the second transport direction. The first transport path **3220** extends to the one-end cutaway part. It is to be noted that the lateral width of the one-end cutaway part is equal to the lateral width of the terminal end part of the first transport path **3220** and is specifically approximately 33 mm.

The outer cylinder **3040** that has slid down on the first transport path **3220** to the one-end cutaway part drops at the stepped part formed under the one-end cutaway part. A height of the stepped part formed under the cutaway part is a height of a part of the one-end part side wall **3232** of the second transport path **3230** that is located under the one-end cutaway part (that is, the inlet **3232***a*). In the present embodiment, the height is greater than the external diameter of the leading-end part of the outer cylinder **3040** (that is, the external diameter of the major diameter part **3041**) and is less than double the external diameter (specifically, approximately 20 mm).

As has been described above, on the side wall **3233** at the other end part of the second transport path **3230** (the end part opposite to the side where the outer cylinder **3040** is passed from the first transport path **3220** to the receiving part **3231** in

the first transport direction), the outlet **3233***a* is formed. As shown in FIG. **42**, the outlet **3233***a* is also a substantially rectangular cutaway part (hereinafter, also referred to as an other-end cutaway part) formed on the upstream side end part of the side wall **3233** in the second transport direction. The third transport path **3240** extends from the other-end cutaway part. It is to be noted that the lateral width of the other-end cutaway part is equal to the lateral width of the starting-end part of the third transport path **3240** and is specifically approximately 30 mm.

As shown in FIG. **42**, a part of the side wall **3233** at the one-end part of the second transport path **3230** that is located under the other-end cutaway part forms a stepped part. A height of the stepped part is less than the external diameter of the leading-end part of the outer cylinder **3040** (that is, the external diameter of the major diameter part **3041**) (specifically, approximately 8 mm).

With the above-mentioned structure, the recess that serves as the receiving part **3231** receives the outer cylinder **3040** that has slid down on the first transport path **3220**. Also, the recess has a depth in the vertical direction which is capable of holding (keeping inside the recess) a single outer cylinder **3040**. That is to say, the outer cylinder **3040** that slides down on the first transport path **3220** while there is no outer cylinder **3040** in the recess drops in the recess and will be held in the recess.

Referring to FIG. **44**A, a mechanism of holding the outer cylinder **3040** in the recess will be described. The outer cylinder **3040** that has slid down on the first transport path **3220** while there is no outer cylinder **3040** drops into the recess in a state where it still maintains a momentum acquired by sliding down on the first transport path **3220**. It is to be noted that the outer cylinder **3040** drops into the recess in a state where the longitudinal direction of the outer cylinder **3040** is substantially parallel to the first transport direction (in other words, in a state substantially perpendicular to the second transport direction). The outer cylinder **3040** that has dropped into the recess (that is, the outer cylinder **3040** received by the recess) is caught by the side wall **3233** formed at the other end part of the second transport path **3230** and is retained in the recess. In other words, the side wall **3233** formed at the other end part of the second transport path **3230** retains the outer cylinder **3040** that has slid down on the first transport path **3220** while there is no outer cylinder **3040** in the recess into the recess.

In detail, the side wall **3233** formed at the other end part of the second transport path **3230** includes a retaining part **3233***b* below the other-end cutaway part (that is, the outlet **3233***a*). This retaining part **3233***b* catches the outer cylinder **3040** that has slid down on the first transport path **3220** while there is no outer cylinder **3040** in the recess. Then, the outer cylinder **3040** caught by the retaining part **3233***b* looses the momentum acquired by sliding on the first transport path **3220** and is retained in the recess.

The outer cylinder **3040** is oriented by the orienting mechanism **3170** and travels on the first transport path **3220** in a state where the leading-end part of the outer cylinder **3040** is located in the upstream side of the rear-end part in the first transport direction. Thus, when the outer cylinder **3040** is caught in the retaining part **3233***b*, the rear end of the outer cylinder **3040** may collide with the retaining part **3233***b*. If the leading end of the outer cylinder **3040** collides with the retaining part **3233***b*, the petaloid part **3044** provided at the end part of the leading-end side will bend inwardly. Since the leading-end opening **3043** is narrowed if the petaloid part **3044** is bent inwardly, there arises a disadvantage that it becomes difficult to insert the tampon main body **3020** or inner cylinder **3050** during the step of inserting the tampon main body **3020** or inner cylinder **3050** into the outer cylinder **3040**. Whereas, in the present embodiment, such a disadvantage can be overcome since the rear end of the outer cylinder **3040** collides with the retaining part **3233***b*.

The outer cylinder **3040** that is retained in the recess serving as the receiving part **3231** moves to the downstream side of the second transport path **3230** as the outer cylinder **3040** located on the more downstream side in the second transport path **3230** moves on the second transport path **3230**. Thus, there will be no outer cylinder **3040** in the recess and the outer cylinder **3040** that is received by the recess thereafter will be retained in the recess.

The outer cylinder **3040** moves on the second transport path **3230** while being restricted by the sidewalls **3232** and **3233** provided on the second transport path **3230**. Specifically, the side wall **3232** formed on the other end part of the second transport path **3230** includes a portion adjacent to the retaining part **3233***b* in the second transport direction (hereinafter, an adjacent part **3233***c*). As shown in FIG. **42**, the height of the adjacent part **3233***c* is greater than the external diameter of the leading-end part of the outer cylinder **3040**. Also, the side wall **3232** formed on the one end part of the second transport path **3230** includes a part opposing the adjacent part **3233***c* (hereinafter, an opposing part **3232***b*). As shown in FIG. **42**, the height of the opposing part **3232***b* is greater than the external diameter of the leading-end part of the outer cylinder **3040**. Thus, the outer cylinder **3040** travels between the adjacent part **3233***c* and the opposing part **3232***b* when traveling on the second transport path **3230**. Thereby, the outer cylinder **3040** traveling on the second transport path **3230** is prevented from falling off from the second transport path **3230**.

On the other hand, the outer cylinder **3040** that has slid down on the first transport path **3220** when there is the outer cylinder **3040** in the recess serving as the receiving part **3231** is discharged out of the second transport path **3230** through the outlet **3233***a*. That is to say, the outer cylinder **3040** received by the recess while the outer cylinders **3040** are accumulated from the starting end to the terminal end of the second transport path **3230** passes by the recess and is passed to the third transport path **3240** through the outlet **3233***a*. This will be described in detail with reference to FIG. **44**B. In the description below, the outer cylinder **3040** that the recess has previously received is referred to as a previous outer cylinder **3040** and the outer cylinder **3040** that slides down on the first transport path **3220** while the previous outer cylinder **3040** is in the recess (that is, the outer cylinder **3040** that the recess subsequently receives) is referred to as a subsequent outer cylinder **3040**.

When the subsequent outer cylinder **3040** drops into the recess after passing by the inlet **3232***a*, it will be stacked on the previous outer cylinder **3040** as shown in FIG. **44**B. That is to say, the recess serving as the receiving part **3231** receives the outer cylinder **3040** that has slid down on the first transport path **3220** when the previous outer cylinder **3040** is in the recess (that is, the subsequent outer cylinder **3040**) in such a manner that it is stacked on the previous outer cylinder **3040**.

The subsequent outer cylinder **3040** that is stacked on the previous outer cylinder **3040** moves in the recess in such a manner that it slides on the previous outer cylinder **3040** (see FIG. **42**). At this time, the subsequent outer cylinder **3040** moves in such a manner that the longitudinal direction of the subsequent outer cylinder **3040** lies along the longitudinal direction of the previous outer cylinder **3040**. That is to say, even after being received by the recess, the subsequent outer cylinder **3040** keeps on traveling in the direction that it has

slid down on the first transport path **3220** (that is, the first transport direction). Thereafter, the subsequent outer cylinder **3040** passes by the outlet **3233***a*. That is to say, the side wall **3233** formed at the other end part of the second transport path **3230** discharges the subsequent outer cylinder **3040** stacked on the previous outer cylinder **3040** out of the second transport path **3230** through the outlet **3233***a*.

In detail, the height of the retaining part **3233***b* formed in the side wall **3233** is less than the external diameter of the leading-end part of the outer cylinder **3040**. Thus, the retaining part **3233***b* can retain the previous outer cylinder **3040** and cannot retain the subsequent outer cylinder **3040** that is stacked on the previous outer cylinder **3040** at the same time. Therefore, since the subsequent outer cylinder **3040** keeps on moving in the recess serving as the receiving part **3231** while maintaining the momentum acquired by sliding down on the first transport path **3220**, it will go over the retaining part **3233***b* and is passed to the third transport path **3240**. (That is to say, it is discharged out of the second transport path **3230** through the other-end cutaway part.)

Then, the subsequent outer cylinder **3040** discharged out of the second transport path **3230** will be returned to the outer cylinder feeder **3121** (specifically, the bottom part of the vibratory table **3121***a* provided in the outer cylinder feeder **3121**) by the third transport path **3240** (See FIGS. **38** and **39**). In other words, the outer cylinder **3040** discharged out of the second transport path **3230** will be transported towards the first transport path **3220** again by the outer cylinder feeder **3121** and circulates between the outer cylinder feeder **3121** and the transport path **3122** until it moves on the second transport path **3230**.

—Effectiveness of Assembling Apparatus **3100** of the Present Embodiment—

According to the assembling apparatus **3100** of the present embodiment, as has been described above, when the supplying mechanism **3120** supplies the outer cylinder **3040**, the outer cylinder **3040** received by the receiving part **3231** when there is no outer cylinder **3040** in the receiving part **3231** is retained in the receiving part **3231** by the side wall **3233** formed on the other end part of the second transport path **3230**. On the other hand, the outer cylinder received by the receiving part **3231** when there is the outer cylinder **3040** in the receiving part **3231** is discharged out of the second transport path **3230** through the outlet **3233***a* formed in the side wall **3233**. Thus, the outer cylinder **3040** can be supplied properly.

Hereinafter, the effectiveness of the assembling apparatus **3100** of the present embodiment will be described with reference to FIG. **45**.

FIG. **45** is a diagram showing the comparison example for explaining the effectiveness of the assembling apparatus **3100** of the present embodiment.

Because of the reasons described above, the outer cylinders **3040** may accumulate on the second transport path **3230** in a side-by-side manner. Further, if the outer cylinders **3040** accumulate from the starting end to the terminating end of the second transport path **3230**, the outer cylinder **3040** cannot be accommodated on the second transport path **3230** anymore. That is to say, the outer cylinder **3040** which the receiving part **3231** has received when there is the outer cylinder **3040** in the receiving part **3231** cannot be accommodated on the second transport path **3230** any more.

As for the outer cylinders **3040** that cannot be accommodated on the second transport path **3230** any more, as shown in FIG. **45**, the outer cylinders **3040** are gradually piled up before the receiving part **3231** (that is to say, at the terminating end part of the first transport path **3220**). At this time, the outer cylinders **3040** pile up in the direction lying along the longitudinal direction of the outer cylinder **3040**. Further, the outer cylinder **3040** is oriented by the orienting mechanism **3170** in such a manner that it travels on the first transport path **3220** in a state where the leading-end part of the outer cylinder **3040** is situated on the upstream side than the rear-end part in the first transport direction. As a result, the outer cylinders **3040** that have piled up before the receiving part **3231** will be joined with each other, as shown in FIG. **45**. That is to say, the above-mentioned jamming occurs before the receiving part **3231**. With the outer cylinders **3040** being joined to each other, each outer cylinder **3040** cannot be supplied individually and thus each of the outer cylinders **3040** will not be properly set on the assembling conveyor **3110**. As a result, the manufacturing speed of the tampon **3010** may be lowered.

On the contrary, according to the present embodiment, when there is a spatial allowance for accommodating the outer cylinders **3040** on the second transport path **3230** (that is to say, when there are no outer cylinders **3040** on the receiving part **3231**), the outer cylinder **3040** that is passed from the first transport path **3220** is retained in the receiving part **3231**. On the other hand, the outer cylinder **3040** that was passed when the outer cylinders **3040** cannot be accommodated on the second transport path **3230** anymore (that is to say, when there are the outer cylinder **3040** in the receiving part **3231**) is discharged out of the second transport path **3230**.

As has been described above, in the present embodiment, depending on the state in which how the outer cylinders **3040** are accommodated on the second transport path **3230**, the outer cylinder **3040** newly passed to the second transport path **3230** from the first transport path **3220** can be transported to a proper transport destination. As a result, the outer cylinders **3040** can be avoided from being piled up before the receiving part **3231** and thus the problem illustrated in FIG. **45**, in other words the jamming in front of the receiving part **3231**, can be eliminated. Therefore, with the assembling apparatus **3100** of the present embodiment, the outer cylinders **3040** can be appropriately supplied individually and the tampon **3010** can be manufactured efficiently.

It is to be noted that in the present embodiment, the internal diameter of the leading-end part of the outer cylinder **3040** (that is to say, the major diameter part **3041**) is greater than the external diameter of the rear-end part (that is to say, the minor diameter part **3042**). In such a case, the rear-end part of the other outer cylinder **3040** can be easily caught into the leading-end part of the outer cylinder **3040** and thus may easily cause the above-mentioned jamming. It is to be noted that when the internal diameter of the leading-end part of the outer cylinder **3040** is the same as or even smaller than the external diameter of the rear-end part, if the petaloid parts **3044** incline outwards and the leading-end opening **3043** broadens, the rear-end part may get caught in the leading-end part. That is to say, even if the internal diameter of the leading-end part of the outer cylinder **3040** is the same as or even smaller than the external diameter of the rear-end part, the jamming could occur and thus the assembling apparatus **3100** of the present embodiment is effective.

In the present embodiment, each of the first transport path **3220** and the third transport path **3240** is inclined in such a manner that the outer cylinder **3040** slides down on each of them and the receiving part **3231** is a recess between the first transport path **3220** and the third transport path **3240**. With such a structure, the outer cylinder **3040** that slides down on the first transport path **3220** when there is the outer cylinder **3040** in the recess is discharged out of the second transport path **3230** by using the momentum acquired by sliding down

on the first transport path **3220**. Thus, the outer cylinder **3040** can be properly discharged out of the second transport path **3230** without separately providing a device for discharging the outer cylinder **3040** out of the second transport path **3230**.

—Other Embodiment—

In each of the embodiments described above, the manufacturing method and manufacturing device (assembling apparatus **3100**) of the present invention has been mainly described, but the above-embodiments are solely for facilitating the understanding of the present invention and by no means regarded as limitations on the present invention. The invention can of course be altered and improved without departing from the gist thereof and equivalents are intended to be embraced therein. Also, the above-mentioned setting values, sizes and configurations, etc., are merely an example provided to show the effect of the present invention and is not to be interpreted as limiting the invention.

In the above-mentioned embodiment, the tampon **3010** having the inner cylinder **3050** of a two-tier structure (in other words, extendable inner cylinder **3050**) as a pushing member has been described, but the present invention is not limited thereto. For example, it can be a tampon **3010** having the inner cylinder **3050** with a fixed length (which does not extend or contract).

Also, in the above-mentioned embodiment, although the outer cylinder **3040** including the major diameter part **3041** and the minor diameter part **3042** has been described, the outer cylinder **3040** may be without the minor diameter part **3042**. That is to say, the external diameter and the internal diameter may be the same between the leading-end part (one-end part in the longitudinal direction) and the rear-end part (other-end part in the longitudinal direction).

Also, in the above-mentioned embodiment, the outer cylinder **3040** that has traveled on the second transport path **3230** is passed from the second transport path **3230** to the assembling conveyor **3110** (specifically, the mount **3160** placed on the assembling conveyor **3110**) via the outer cylinder setting part **3123**. That is to say, in the above-mentioned embodiment, the second transport path **3230** is a part of the transport path **3122** that is nearest to the assembling conveyor **3110**, but is not limited thereto. The second transport path **3230** may be a porition of the transport path **3122** that is not nearest to the assembling conveyor **3110** and can be, for example, apart that is midway on the transport path **3122**.

LIST OF REFERENCE NUMERALS

1001 tampon, **1004** tampon main body, **1005** absorbent body, **1008** cord, **1010** applicator,
1011 outer cylinder (accommodating member),
1012 minor diameter part, **1013** major diameter part,
1014 leading-end opening, **1015** petaloid part, **1016** rear-end opening,
1017 annular protrusion, **1018** stepped part,
1020 inner cylinder (pushing member), **1021** first inner cylinder,
1022 flange part, **1023** annular protrusion, **1025** second inner cylinder,
1026 flange part, **1027** protruded part, **1028** flared part,
1040 assembling apparatus (apparatus for manufacturing tampon),
1041 outer cylinder supplying part,
1042 outer cylinder transport feeder, **1042***a* vibratory table,
1043 transport path, **1044** accumulating part, **1045** drop chute,
1046 accumulating part, **1050** transport conveyor,
1051 first inner cylinder supplying part,
1052 second inner cylinder supplying part,
1053 inner cylinder transport feeder,
1053*a* vibratory table, **1054** transport tube (first inserting mechanism),
1055 rail, **1060** orientation orienting mechanism (orienting mechanism),
1061 orienting plate, **1062** opening, **1062***a* one-end opening,
1062*b* center opening, **1062***c* other-end opening,
1063 first protruded part, **1064** second protruded part,
1067 first jet part, **1067***a* nozzle, **1068** second jet part,
1068*a* nozzle,
1070 tampon main body inserting part (second inserting mechanism),
1071 guide part, **1072** pin, **1081** transport roller,
1082 transport roller, **1084** bent part,
2010 tampon, **2020** tampon main body, **2021** cotton body, **2022** cord,
2030 applicator, **2040** outer cylinder (accommodating cylinder),
2041 major diameter part, **2042** minor diameter part,
2043 leading-end opening (opening), **2044** petaloid part,
2045 rear-end opening, **2046** annular rib, **2047** stepped part,
2050 inner cylinder (pushing member), **2051** first inner cylinder,
2051*a* flange part, **2051***b* annular protrusion,
2052 second inner cylinder, **2052***a* flange part,
2052*b* protruded part, **2052***c* flared part,
2100 assembling apparatus (apparatus for manufacturing tampon **2010**),
2110 transport conveyor, **2120** outer cylinder supplying mechanism,
2121 outer cylinder transport feeder, **2121***a* vibratory table,
2122 transport path, **2122***a* accumulating part, **2122***b* drop chute,
2122*c* accumulating part,
2130 inner cylinder inserting mechanism (pushing member inserting mechanism), **2131** first inner cylinder inserting mechanism,
2132 second inner cylinder inserting mechanism,
2133 inner cylinder transport feeder, **2133***a* vibratory table,
2133*b* rail, **2134** supplying tube, **2135** inner cylinder inserting part,
2135*a* pressing member, **2140** tampon main body inserting mechanism,
2141 guide tube, **2142** suction device, **2143** pressing member,
2150 broadening mechanism, **2151** first pusher unit,
2152 second pusher unit, **2153** third pusher unit, **2160** mount,
2160 mounting jig, **2200**, **2210** pusher (jig),
2201, **2211** tapered part,
2201*a*, **2211***a* outer peripheral surface,
2202, **2212** projected part,
2202*a*, **2212***a* projected surface (surface at the leading end of the projected part **2002** and projecting towards outside than the outer edge of the rear end of the tapered part **2201**),
2220 attachment plate, **2230** auxiliary pusher (other jig),
2231 other tapered part, **2231***a* outer peripheral surface,
3010 tampon,
3020 tampon main body, **3031** cotton body, **3022** cord, **3030** applicator,
3040 outer cylinder (accommodating cylinder), **3041** major diameter part,
3042 minor diameter part, **3043** leading-end opening (opening),
3044 petaloid part, **3045** rear-end opening, **3046** annular rib,
3047 stepped part, **3050** inner cylinder (pushing member),
3051 first inner cylinder, **3051***a* flange part,
3051*b* annular protrusion, **3052** second inner cylinder,

3052*a* flange part, **3052***b* protruded part, **3052***c* flared part,
3100 assembling apparatus (apparatus for manufacturing tampon **3010**),
3110 assembling conveyor, **3120** supplying mechanism,
3121 outer cylinder feeder (parts feeder),
3121*a* vibratory table (placing table),
3122 transport path, **3123** outer cylinder setting part,
3123*a* outer cylinder receiving table, **3130** inserting mechanism,
3140 inner cylinder inserting mechanism,
3141 first inner cylinder inserting mechanism,
3142 second inner cylinder inserting mechanism,
3143 inner cylinder feeder, **3143***a* vibratory table,
3143*b* rail, **3144** tube, **3145** inner cylinder pushing device,
3145*a* pressing jig, **3150** tampon main body inserting mechanism,
3151 guide tube, **3152** suction device,
3153 tampon main body pressing device,
3160 mount, **3161** hole,
3170 orienting mechanism, **3171** hole,
3172 first protruded part, **3173** second protruded part,
3200 guide path, **3210** drop chute, **3211** opening,
3220 first transport path, **3230** second transport path,
3231 receiving part, **3232** side wall, **3232***a* inlet,
3232*b* opposing part, **3233** side wall, **3233***a* outlet,
3233*b* retaining part,
3233*c* adjacent part (part adjacent to retaining part **3233***b* in the second transport direction),
3234 restricting plate, **3240** third transport path

The invention claimed is:

1. An apparatus for manufacturing a tampon, the tampon including an absorbent body for absorbing liquid, an accommodating member that is cylindrical and accommodates the absorbent body, and a pushing member that is configured to move inside the accommodating member and push the absorbent body out of the accommodating member, the accommodating member including a minor diameter part provided at a first end thereof and a major diameter part provided at a second end thereof, the major diameter part having an external diameter greater than that of the minor diameter part, the major diameter part, at a leading end thereof, including a plurality of petaloid parts, said apparatus comprising:

an orienting mechanism configured to orient the accommodating member;

a first inserting mechanism configured to insert the pushing member into the accommodating member oriented by the orienting mechanism; and

a second inserting mechanism configured to insert the absorbent body into the accommodating member in which the pushing member is inserted,

the orienting mechanism including:

an opening through which the accommodating member is inputted;

a pair of first protruded parts located on a first side in a longitudinal direction of the opening and protruding inwardly in an opposing manner into the opening; and

a pair of second protruded parts located on a second side in the longitudinal direction of the opening and protruding inwardly in an opposing manner into the opening,

a gap between the pair of first protruded parts configured to be greater than the external diameter of the minor diameter part and smaller than the external diameter of the major diameter part, and

a gap between the pair of second protruded parts configured to be greater than the external diameter of the minor diameter part and smaller than the external diameter of the major diameter part,

wherein

when the opening of the orienting mechanism receives the accommodating member in a manner that a longitudinal direction of the accommodating member lies along the longitudinal direction of the opening,

one of the pair of first protruded parts and the pair of second protruded parts is positioned where the minor diameter part passes between said one of the pair of first protruded parts and the pair of second protruded parts, and

the other of the pair of first protruded parts and the pair of second protruded parts is positioned (a) where the major diameter part cannot pass between said other of the pair of first protruded parts and the pair of second protruded parts and (b) to contact with a part of the accommodating member that is nearer to a center of the accommodating member in the longitudinal direction than the petaloid parts.

2. An apparatus according to claim **1**, wherein, when the opening of the orienting mechanism receives the accommodating member in such a manner that the longitudinal direction of the accommodating member lies along the longitudinal direction of the opening,

the other of the pair of first protruded parts and the pair of second protruded parts is positioned to contact with the part of the accommodating member that is closer to the petaloid parts than to the center of the accommodating member in the longitudinal direction.

3. An apparatus according claim **1**, wherein

the accommodating member includes an annular protrusion provided nearer to the first end than the minor diameter part,

the gap between the pair of first protruded parts and the gap between the pair of second protruded parts are configured to be smaller than an external diameter of the annular protrusion, and

when the opening of the orienting mechanism receives the accommodating member in such a manner that the longitudinal direction of the accommodating member lies along the longitudinal direction of the opening,

the one of the pair of first protruded parts and the pair of second protruded parts is positioned to not come into contact with the annular protrusion.

4. An apparatus according to claim **1**, wherein the orienting mechanism further includes:

a first jet part that is provided at a position opposing the first protruded parts and configured to inject air towards the first protruded parts; and

a second jet part that is provided at a position opposing the second protruded parts and configured to inject air towards the second protruded parts.

5. An apparatus according to claim **1**, further comprising:

a transport path configured to transport the accommodating member and to input the accommodating member into the opening,

wherein

the transport path has an accumulating part configured to accumulate a plurality of accommodating members in a side-by-side manner, and

the transport path is configured to input the accommodating members accumulated in the accumulating part one-by-one into the opening in such a manner that the major diameter part of the inputted accommodating member comes into contact with said one of the pair of first protruded parts and the pair of second protruded parts.

6. An apparatus according to claim 1, wherein

the opening has a rectangular shape, and

a distance in the longitudinal direction between an edge of the opening on the first side and the first protruded parts is equal to a distance in the longitudinal direction between an edge of the opening on the second side and the second protruded parts.

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